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OFFICIAL PUBLICATION OF THE PROCEEDINGS, AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday, by the **HOWES PUBLISHING COMPANY, INC.**, 44 East 23rd Street, New York 10, N. Y. **C. R. Howes**, President; **Ernest J. Finan**, Executive Vice-President; **Norman A. Johnson**, Vice-President & Treasurer; **Myron D. Reeser**, Vice-President; **Clara Patrick**, Secretary.

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AMERICAN
DYESTUFF REPORTER

DEVOTED TO TEXTILE WET-PROCESSING

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AMERICAN
DYESTUFF REPORTER
Volume 48 June 1, 1959 Number 11

EUROPE'S MODEL TEXTILE FINISHER

DR F G C MEYER

Director of Research
Koniklijke Twentse Stoomblekerij
Goor, Holland

A five-year modernization plan including the very latest ideas in processing and control systems has made this 120-year-old finisher the talk of the Continent.

INTRODUCTION

THROUGH a complete mill modernization including over $125,000 in process controls, the 120-year-old Royal Twentsche Steam Bleachery (TSB) of Goor, Holland has become one of Europe's most modern textile mills. Textile executives from as far away as Scandinavia and Italy are visiting the mill every week to examine the new ideas in processing and control systems now in use.

TSB's decision to undertake a vast modernization program in 1952 was not based merely on the whim of management to "keep up with the times." In 120 years, TSB had developed from a small, one-machine finisher, in a textile processing area similar to Gaston County, SC, to the largest single finishing plant in Europe. TSB was called on to process about 440,000 lbs of assorted fabrics a week to meet the demands of what is considered by many as the world's most discriminating textile market.

Further, TSB has always been in the highly competitive position of being purely a contractor (commission house). All its work must come from the outside. Thus, quality, top grade performance, and absolute efficiency of operation were a must if the company was to operate at a profit for it must meet competitive bids for the work and still satisfy the demands of the European market for quality. TSB arrived at the systems in conjunction with the Amsterdam branch of Honeywell Controls Ltd.

Three of these systems should be of particular interest to textile personnel—the water supply system, the continuous bleach ranges, and the continuous dyeing ranges. All three are in some part responsible for increased overall productivity, and closer quality reproducibility. By eliminating many slow hand operations, the new processes have contributed greatly to cutting down the amount of time needed to process an order from receiving to shipping. Further, to some extent, each of these systems features new and unusual thoughts in textile processing that should be useful and informative to textile people everywhere.

WATER TREATMENT

First in the mind of every wet processor is the problem of water—pure water, chemically balanced to suit his particular needs. This water seldom comes directly from the source of supply. Almost always, it must be treated to make it most efficient as a processing agent. At TSB, the problem assumes major proportions. Textile finishing operations use an overwhelming quantity of water. We get all we need from artesian wells on our own property and process it ourselves. Thus, it is only

Figure 1
All water used at TSB is pumped from its own wells near the mill through these weirs. The weir flowmeter indicates total water flow and re-transmits its measuring signal to a recorder in the pump house.

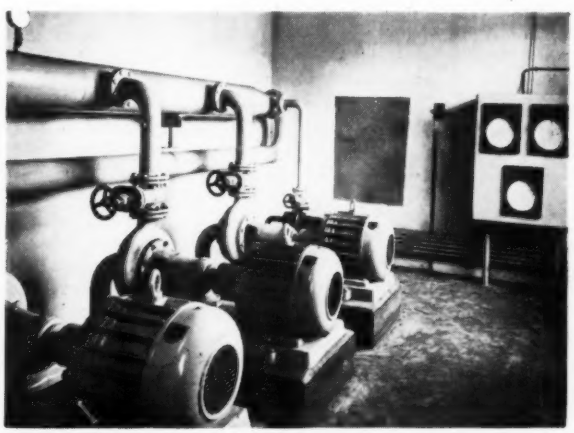


Figure 2
These pumps distribute water both directly to the mill and to the demineralization plant for boiler use. The recorders on the top of the panel record outgoing flows to the mill and the water-treatment plant respectively. The bottom recorder shows incoming water as measured by the weir flowmeter.

natural that we maintain an elaborate instrument system to keep a close watch on the treatment system and expensive chemicals we employ.

Fron nine wells, located near the mill, the water is pumped to a concrete weir where an indicating weir flowmeter with a range of 0-500 cubic meters per hour measures the total flow on its way to the mill. At the same time, this instrument transmits an electrical signal equivalent to the measured water flow to a recorder in the main pumping station about 1000 feet away. This gives us a permanent record of well-pump performance.

A low limit switch incorporated in the flow recorder actuates a visible and audible alarm when the total water flow reaches a certain preset minimum. Ordinarily, this flow is reached only when troubles occur at any of the well pumps. Through this warning system, pump trouble can be detected and averted before a serious shortage of water develops.

From the main pumping station about 135 cu meters per hour of water is pumped to the water treatment facility, comprising a 25 cu meters per hour demineralizing plant and a 115 cu meters per hour softening plant. About 250 cu meters per hour is pumped directly to the mill for general use (washing, quenching, etc). Each of these flows from a pump station is separately measured by a Differential Converter transmitter, which transmits a pneumatic signal to a recording receiver located in the pumping station. By combining the weir flow recorder receiver and the above two flow recorders on one panel, we provided the operator with a simple, continuous indication of the performance of the water supply system and the amount of water consumed by the mill. Electronic integrators incorporated in the receivers enable the operator to detect any losses incurred in the transport system during sedimentation, filtration, etc.

DEMINERALIZING PLANT INSTRUMENTATION

Since water from the mill wells contains a relatively large percentage of impurities, demineralizing is absolutely necessary for operation of the high-pressure boiler house. About 20 cubic meters per hour of water is processed by the demineralizing plant and delivered to the boiler house. The demineralizing instrumentation measures flow, conductivity, and level to guard against any increase in impurities entering the boiler and provide warning of any decrease in filter efficiency. The plant consists of a pair of cation exchangers, a pair of anion exchangers, and a vessel linked between the sections to release carbon dioxide gas from the cation effluent.

Water delivered to each of the four ion exchangers is measured by a Differential Converter transmitter, which transmits its signal to a panel-mounted recording flow receiver. Thus, a permanent record of water flow through each individual ion exchanger is provided for reference. Also an electronic flow integrator mounted in each recorder indicates the total amount of water handled by each exchanger during a 24-hour period. This integrating feature is particularly important during backwashing, rinsing, etc, because the operator reads from the integrators the amounts of expensive chemicals and water used and can watch fluid speeds through the resin beds.

The concentration of impurities present in the water is continuously measured and recorded at various stages of the process by conductivity cells connected to two multipoint strip chart recorders. One instrument measures conductivity in the raw water influent line and the cation exchanger effluent lines and has a range and scale of 0-1500 micro-mho. The other strip chart recorder (0-50 micro-mho) measures the conductivity in the anion exchanger effluent lines. Both recorders have high-limit alarm switches, which actuate signal lights and audible alarms. An alarm is sounded when filter performance drops below a certain level and regeneration of the ion-exchange sections becomes necessary.

The alarm in the anion section recorder guards against impurities in the water going to the boiler house. As a check on anion regeneration, two extra cells are located in the anion exchange section themselves. Normally these are connected to the anion section recorder (range 0-50 micro-mho). However, they may be selectively switched to the high-range recorder serving the cation exchange section (0-1500 micro-mho) during regeneration of the anion exchange sections. The recorder turns on a signal light when the conductivity during regeneration reaches a preset minimum level, ie, when regeneration of the anion section is completed. This guards against excessive use of very expensive regeneration fluid and results in a definite material saving and increase in plant efficiency over our older methods.

Water level in the carbon dioxide column between the cation and anion exchange sections must be controlled because of possible variations in supply to and demand from the demineralizing plant. The system consists of an air-purge-type liquid level control using a nonindicating pressure controller connected to a 2½" pneumatically operated Saunders control valve mounted in the cation-exchanger effluent lines. The Saunders valve is glass lined with a Teflon diaphragm to handle the diluted acids delivered by the cation exchanger. The amount of air pressure required to force bubbles from a standpipe is used as a measure of liquid head. Any variation from a preset level causes the controller to actuate the Saunders valve to correct the situation.

With the control systems outlined above, TSB has been able to make a substantial savings in processing materials and has yet to have any sort of a breakdown in either its boiler system or its water supply system. The instrument system has been particularly helpful in cutting maintenance costs and allowing us to spot either pump trouble or faulty ion-exchanger linings before they can do any damage to our processes.

ACTUAL MILL PROCESSES

For efficiency and high-quality production, the Company has elected to use continuous processing for both dyeing and bleaching. Both departments rely heavily on instrumentation for maximum production with minimum consumption of processing fluids and a resulting low cost of operation. But, at no point is quality sacrificed, as the principle aim of the company is the continuous production of the very highest quality work.

BLEACHING———Most of the cloth to be dyed and all cloth to be delivered by TSB to the customer as white goods must be bleached. Bleaching is the prime business of the Company, and the equipment and method used to carry out the process reflect its importance. TSB employs heavily instrumented and complex continuous bleach ranges. TSB's method, largely a result of work by the author, has allowed up to 50 percent savings in consumption of expensive hydrogen peroxide with a constant yield of uniformly high-quality bleached cloth.

TSB uses two ranges with capacities between 120 and 150 meters per minute each. Cloth is first fed to a singer where gas flames burn away the fibers that come out of the yarns during weaving. It is then passed through a desizing unit where enzymes change the insoluble size (us-

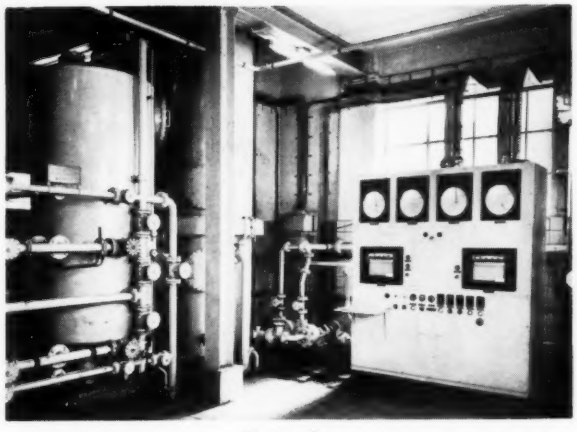


Figure 3

At the demineralizing plant, water is purified by running through a cation and anion exchanger. The top left pair of flowmeters on the panel record influent to the pair of cation exchangers; the right pair record influent to the anion exchangers. The multipoint strip chart recorders show conductivity at various points in the process.

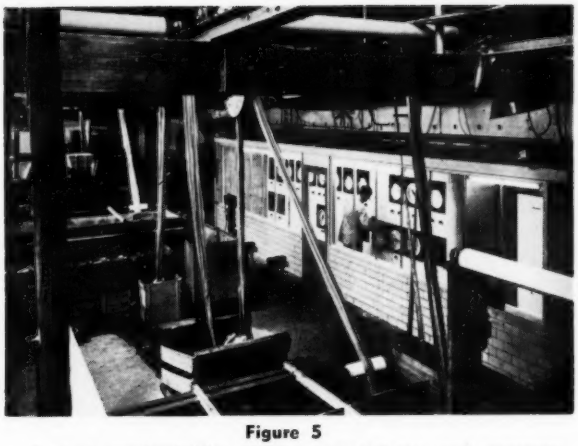


Figure 5

Critical conductivities, flows, temperatures and pressures are recorded and controlled for the continuous dyeing range at this panel.

ually starch) to soluble sugars, which can be washed out of the fabric.

At the desizing tank, a square case remote bulb thermometer indicates and controls the temperature by operating a diaphragm control valve in the steam line. Since pH is very important for complete and economical desizing, this variable must be controlled. Control is accomplished by suspending pH electrodes in the solution, which are connected to a pH amplifier that feeds its signal to a circular chart recorder controller equipped with pneumatic proportional-plus-reset control. The control in turn operates a diaphragm control valve in a diluted NH_4OH line to maintain the proper pH. Since level is equally important to maintain an even saturation rate, it is controlled by a bubbler system and a nonindicating pressure controller. This controller operates a valve in the solution line to keep level constant.

After saturation with desizing solution, the cloth passes to a J box where it is held for about one hour. This J box carries no controls because the operation is handled at ambient temperature.

When the cloth leaves the first J box, it passes through a temperature- and level-controlled washer to remove size. Temperature control is achieved through a circular chart recording controller with pneumatic proportional-plus-reset control that operates a valve in the steam supply line to keep temperature at exactly the right point. Pneumatic proportional-plus-reset control is used with all recording and indicating units in the plant where control is necessary. Level is controlled by a pressure controller connected to a bubble pipe inserted in the slasher. The output signal of this controller operates a control valve in the water outlet line.

Electric-pneumatic relays switch the washer to "recirculating" as soon as the drive motors are switched off. This is done because the relays are operated by the "start-stop" push button of the machine. The relays

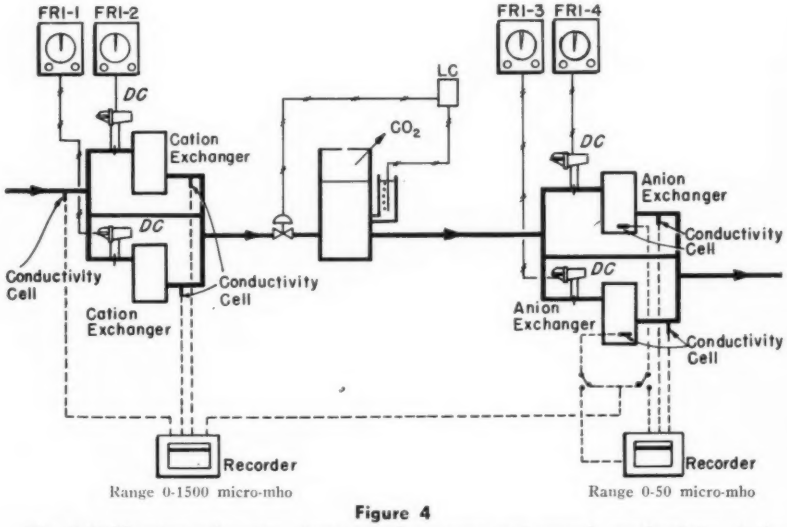


Figure 4

The 0-1500 micro-mho strip chart recorder senses and records conductivity of the cation influent and cation effluents. The 0-50 micro-mho strip chart recorder records conductivity in the anion exchangers and effluent lines. A switching arrangement allows the conductivity cells in the anion exchangers to be switched to the higher range recorder during regeneration of the exchanger linings.

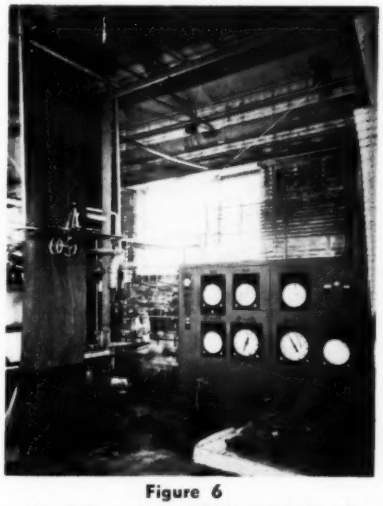
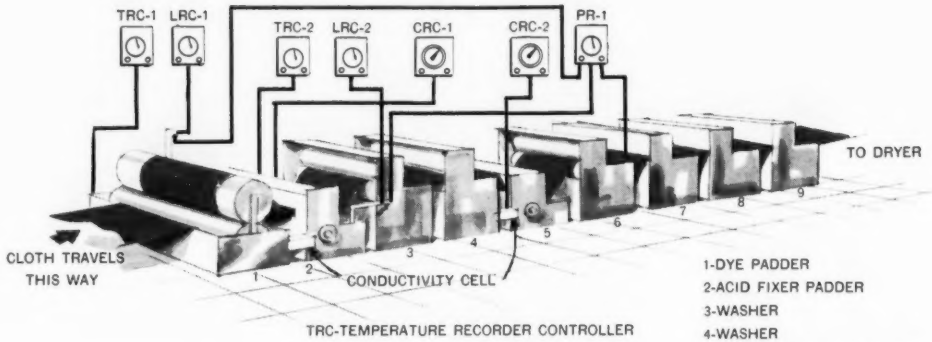


Figure 6

At this main control panel in the bleachery department of TSB, solution conductivities, J box temperatures, and squeeze roll loadings are recorded and controlled for the entire range.



These drawings are only for purposes of showing where instruments are located and do not represent the actual method of bleaching used at T S B.

Figure 7

This unique dyeing range uses conductivity cells and recorder-controllers to maintain fixing and neutralizing solution concentrations.

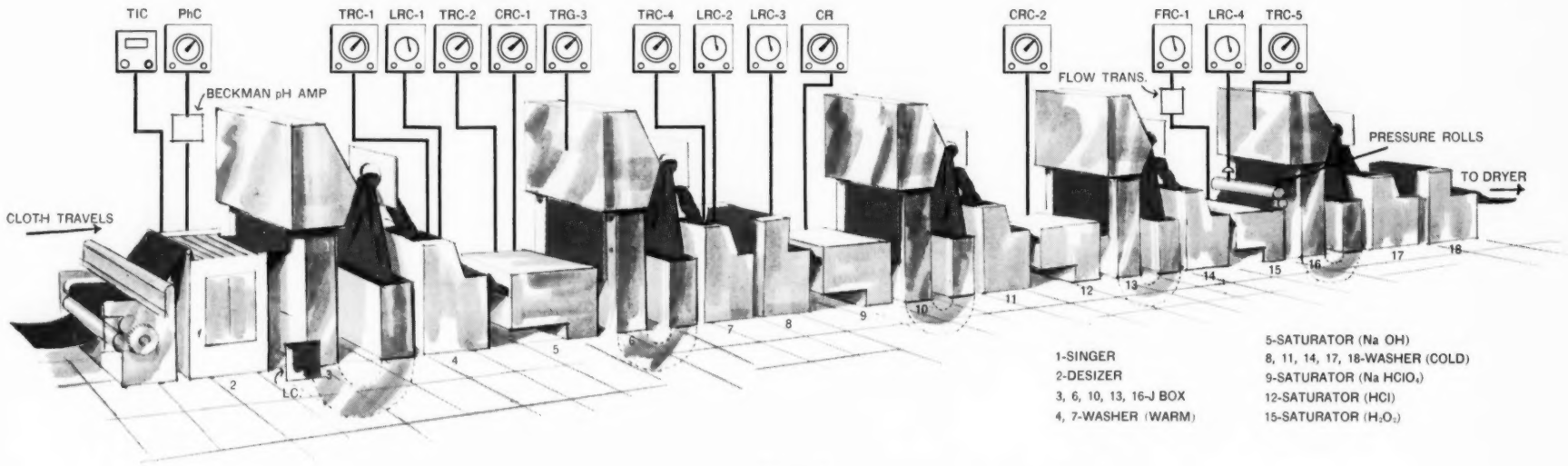


Figure 8

In this unique continuous bleach range, sodium hypochlorite and hydrochloric acid replace the usual hydrogen peroxide bleach in the first stages. This has resulted in a saving of about 50 percent in expensive hydrogen peroxide consumption.

vent the controlled air line to the level control valve so as to close it, and open a recirculating valve. The relays can be operated manually to "recirculating" position during the warm-up period of the machine. This simple relay arrangement yields a tremendous overall saving in water and steam.

After having passed this washer, the cloth enters a sodium hydroxide saturator where the first stage of the bleaching process starts.

Concentration of the caustic solution in this saturator is controlled by using a conductivity cell in the bath, which feeds its signal to a circular chart recording controller with control unit. This control operates a valve in the solution concentrate line to keep the solution at its proper strength.

After the cloth leaves the sodium hydroxide saturator, it is allowed to remain in another J box for approximately one hour. Temperature here is carefully controlled.

J box temperature control, being a rather tricky problem, calls for a special control system. Our J boxes are of the DuPont type, which have steam admitted at the top. After passing the steam-inlet, the cloth descends in the long leg of the J box, which is about five meters high. Steam supply is controlled by a circular chart recording controller. This instrument operates from the average output of three thermocouples located in the long leg of the J box so as to provide the average temperature of a vertical temperature gradient in the upper section of the box.

For satisfactory control, we must determine the exact location of the thermocouples to measure the true inside temperature of the J box without having them protrude from the inner wall of the box. We decided on thermocouple location by measuring temperature at a number of places in the J box. P V C isolated copper-constantan 24-gauge thermocouple wire was inserted in each selected spot and connected to a 16-point temperature recorder. Thus, a record was obtained showing the temperature distribution to the J box. From these records, the most favorable location was determined for the definite installation of the three thermocouples mentioned above, at the section of the J box where the vertical temperature gradient is maximum. Here, possible variations in steam supply cause a considerable shift of temperatures. Closest control of the steam supply can be achieved through measurements of the average of the temperature gradient at this point.

The problem of protrusion was solved by developing a special thermocouple for permanent installation in the J box. Largely through trial and error, a definite design was adopted consisting of a one-inch OD Teflon bar about two inches long inserted in a stainless-steel union. Through the center of this Teflon bar, a small hole is drilled and isolated thermocouple wire is drawn through. The thermocouple hot junction is soldered to a small silver capsule, which is driven in the Teflon bar. Thus the hole is closed off and the hot junction is flush with the Teflon surface. Using this thermocouple design, we get high speed of response, extremely small heat transfer from the hot junction to the J box wall, the hot junction flush with the J box inner wall, screw-in construction, and low cost. The J box temperature control system is now easily able to keep the average temperature within 0.5°C.

When the cloth leaves the J box, it is washed in a temperature- and level-controlled washer and in a cold washer, and then passed on to pick up sodium hypochlorite. In the hypochlorite saturator, conductivity is recorded by a circular chart recorder. From the saturator, the cloth enters a J box where the cloth is bleached at ambient temperature with no controls necessary.

After hypochlorite treatment in the J box, the cloth is washed again, saturated with weak hydrochloric acid, and allowed to stand in another J box for one hour at ambient temperature. In the case of the acid saturator, conductivity control is employed to maintain the required solution strength. A circular chart instrument connected to a conductivity cell is used. The control unit of the instrument operates the acid supply valve. This continuous process using sodium hypochlorite and hydrochloric acid instead of hydrogen peroxide was developed by TSB. Bleaching is so satisfactory that any goods to be dyed are removed from the range after only hypochlorite and acid treatment; washed, and sent to the dyehouse.

Fabric to be delivered to the customer as white goods continues on the range. After washing, it is saturated with hydrogen peroxide and delivered to another J box where it is steamed again for about one hour. Hydrogen peroxide solution flow to the saturator is measured by a flowrator with pneumatic transmitter. The output signal of this flow-transmitter is fed to a pneumatic receiver with control. which operates a valve in the peroxide solution line. Thus. a constant flow of peroxide solution is maintained. Level in the peroxide saturator is controlled by a recording level controller connected to a bubble pipe. The control signal of this instrument is fed to the squeeze rolls so as to change squeezing effect according to the size of the signal. All in all, the level control system compensates for variations in liquid carried over by the cloth from previous processing stages.

The described method of bleaching has produced excellent results for white goods, is more gentle and more thorough than normal continuous methods, and cuts hydrogen peroxide consumption by 50 percent.

DYEING —— TSB's continuous dyeing machines run at speeds up to two meters per second and are called upon to process about 60,000 meters of cotton cloth each day. Although it is not unusual to expect a modern textile machine to run this amount of cloth through its various operations at high speeds, we also expect these machines to produce a strictly uniform color along the breadth and length of the full 60,000 meters daily production. This is exactly what we have succeeded in doing, thanks to the ability of our control instruments to reproduce precisely all critical processing conditions day after day.

Just to illustrate how critical certain variables in our dyeing operation can be, a one-inch level deviation in a dyeing tank may result in color variations easily detectable by the human eye. The same effect might result from a 5°C temperature deviation in this tank. And, a slight variation of the acid concentration in the fixation tanks is sufficient to cause off-grade coloring and make the work totally unacceptable for TSB. These factors dictate the need for a centralized control panel, clearly showing the critical variables, so that an operator can take immediate action if trouble should occur anywhere in the process. Naturally it is imperative that these variables be recorded for future reference.

During dyeing, the cloth is subject to various successive operations, mainly: application of the dye, fixation of the dye, neutralizing, and soaping (seasoning). Between these operations the cloth passes through several washing stages to prevent carry-over of solutions from one compartment to another. We employ a pad-steam range for vat dyeing and another machine for processing of either direct dyes, or leucoesters of vat dyes. The instrumentation described covers the latter machine, the former being largely identical.

Padder Control. In the first operation, dye is applied to the cloth by

50 percent in expensive hydrogen peroxide consumption.

padders. Level and temperature control are essential at this point because both variables have great influence on the pickup of the cloth. Since the cloth is passed through squeeze rolls to remove excessive dye before moving on to a second stage, the pressure applied by these squeeze rolls also becomes a critical variable.

Liquid level in the padder is measured by a bubbler system immersed in a standpipe and attached to the tray to eliminate any dye variations caused by turbulence of the liquor in that tray. The pressure required to force air bubbles from the bubble pipe into the liquid is directly proportional to the head of the liquid in the tray. Thus, this pressure in the bubble pipe is directly related to liquid level. A recording pressure controller, connected to the bubble pipe, provides a constant record of dye level. Through its control unit, this instrument operates a diaphragm control valve in the dye supply line to provide just the right amount of dye at all times. A control unit mounted on the air line to the dye-valve trips a switch when the instrument signal reaches 15 psi (if the control valve approaches its fully opened position). This switch actuates an audible alarm to warn the operator that the dye tank is nearly empty, and appropriate action should be taken. This feature is indispensable on a high-speed machine.

Temperature of dye in the padder is controlled by a filled system thermometer-controller that operates a diaphragm control valve in a supply line admitting steam to the padder.

Double-acting diaphragm power units are used to load the squeeze rolls of each device in the range. Pressure applied to these power units is adjusted by manually operated pressure regulators. Because of the critical nature of roll loading, a pressure recorder is applied to each station to obtain a permanent record for future reference.

Control of Fixation Process (Leucoester Dyeing). When the moving cloth leaves the dye padder, it passes through a dilute solution of sulfuric acid that stabilizes or "fixes" the dye on the fibers. In the fixation tank, level, temperature and acid concentration must be very carefully controlled.

Temperature and level control in the fixation compartment are handled in exactly the same manner and by the same type instruments as used on the padder—temperature by regulation of the steam supply; level by regulation of the water supply. Acid concentration is measured by a conductivity cell, which is inserted in the side of the tank and connected to a circular chart recorder-controller with a range of 20,000-200,000 micro-mho. The strength of the acid solution is maintained at the desired value by a diaphragm control valve in the sulfuric acid line, which is operated by the controller in the instrument. In direct dyeing, the same conductivity control system is used, but a salt solution is supplied by the control valve instead of acid.

Control of the Neutralizing Tank. After a thorough washing, the cloth enters a neutralizing tank containing a sodium hydroxide solution, which will remove all acids carried over from the previous stages. The strength of this solution is particularly important because any acidity left in the cloth after neutralizing is detrimental to the soaping baths and can cause serious damage to the cloth during drying. Sodium hydroxide concentration is controlled by a circular chart controller with a scale of 0-20,000 micro-mho, which is connected to a conductivity cell in the side of the tank. The instrument's control unit operates a diaphragm control valve in the solution line to maintain a preset level. The temperature of the neutralizing bath is kept constant by another nonindicating pneumatic controller, which operates a steam valve to admit steam to the bath.

After neutralizing, the cloth is washed and then thoroughly soaped to complete fixation and provide the ultimate dye treatment. Temperature control of the soaping bath is handled by nonindicating controllers, which operate valves to admit steam to the tanks as needed.

CONCLUSION

At certain points in our processes described here, the instrumentation may seem slightly in excess of that which is normal in progressive U S mills. However, the Company cannot set its own standards as part of an integrated production program as many U S mills do. Rather, we must depend entirely upon outsiders for our business, and their demands are very exacting. Also, we must produce the very high quality demanded by these people with a minimum of costly materials and labor. Therefore, purely from the economic view of making a profit on our operations, we must make maximum use of every precision device and modern process development available to us.

Since the introduction of complex instrumentation, part of which is set forth here, we have noticed a number of very striking improvements in production and efficiency. Some have actually been measurable, such as the tremendous saving of hydrogen peroxide in the new bleaching department. Others, unfortunately, cannot be comparatively stated because few, if any, detailed records were maintained before the heavy introduction of instruments. But, of this we can be certain: at TSB there has been a marked increase in overall productivity and in the savings of time and ease of operation so important to a commission bleachery since the modernization of our mill. How much of this can be directly attributed to the introduction of complex process instrumentation no one can say. However, we are sufficiently convinced that instrumentation is one of the major improvements essential for the continued profit of a modern textile plant, that we presently have our engineers in conference with the experts at Honeywell's Amsterdam office to develop control systems for two major departments that yet remain without instruments.

General Calendar

AMERICAN OIL CHEMISTS SOCIETY
Sept 28-30 (Statler Hotel, Los Angeles, Calif)

AMERICAN TEXTILE MACHINERY ASSOCIATION
May 23-27, 1960 (American Textile Machinery Exhibition, Auditorium, Atlantic City, NJ)

ASSOCIAZIONE COSTRUTTORI ITALIANI DI MACCHINARIO PER L'INDUSTRIA TESSILE
September 12-21 (3rd International Textile Machinery Exhibition, Milan Fair, Milan, Italy)

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS (QUEBEC SECTION)
June 20 (Annual Golf Tournament)

DRUG, CHEMICAL AND ALLIED TRADES SECTION, NY BOARD OF TRADE
Sept 17-20 (69th Annual Meeting, Sagamore Hotel, Bolton Landing, Lake George, NY)

GORDON RESEARCH CONFERENCE ON TEXTILES
July 13-17 (Colby Jr College, New London, NH)

NATIONAL COTTON COUNCIL
Oct 7 (Chemical Finishing Conference, Mayflower Hotel, Washington, DC)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
June 9, Sept 15, Oct 13, Nov 4 (Luncheon meetings at the Hotel Roosevelt, New York, NY); Dec 2 (Annual meeting and dinner—Hotel Roosevelt, New York, NY)

TEXTILE RESEARCH INSTITUTE
March 24-25, 1960 (30th Annual Meeting, Hotel Commodore, New York, NY)

Proceedings of the

American Association of Textile Chemists and Colorists

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June 1, 1959

Northern New England Section———

POLYMERS AS RELATED TO FABRIC PROCESSING*

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Technical Director
UBS Chemical Corp

HERMAN F MARK
Polymer Research Inst

DONALD GAGLIARDI: I have been asked to cover the general section of thermosetting materials by giving some introductory remarks, so that you can ask questions later on in the program on specific subjects.

I have slanted my preliminary remarks (and I hope that this discussion will continue on this topic) toward the subject of "Chemically Active or Thermosetting Finishes".

One of the most important developments in the field of textile finishing in recent years has been the growing emphasis on finding and utilizing chemically active products which can produce permanent (or at least durable) functional effects on textile materials. The importance of this philosophy to the ultimate textile consumer cannot be underestimated, since it means better performance of the textile item and better value for the dollars spent than was available from previous forms of simple loading and coating with inert chemical products.

The achievement of such improved textile finishing effects has resulted from the development and utilization of monomers, polymers, resins, and even simple chemicals which have functional groups capable of reacting either with the fiber substrate or with themselves to form permanent or durable bonds in or on the textile material. These results are well demonstrated in such present reactive products as:

1) Chlorine-resistant "wash-and-wear" finishes for cotton and rayon fabrics based on water-soluble epoxy resins, ethylene urea, triazone, triazine, melamine, and polyol formaldehyde resins.

2) Polymeric condensates of stearamide with alkoxymethylated melamine and ureas for durable water repellents.

3) Organofunctional silicones capable of reacting with glass fibers and later with other coating, moulding or laminating epoxy, phenolic, polyester, and melamine resins for industrial and other applications of fiber glass.

4) Copolymers and terpolymers of the lower acrylic esters having functional groups which can react with the fibrous substrate to render these normally thermoplastic materials infusible and no longer removable by drycleaning solvents and soap-washing operations. Applications of reactive thermoplastic emulsion polymers cover such fields as nonwoven fabric adhesives, pigment binders, wool feltproofing, "wash-and-wear" finishes for cotton and rayons and heatsetting pressure-sensitive adhesive textile tapes.

In the field of cotton and rayon modification, a wide variety of new reactive chemical finishes has become prominent. The great demand for completely washable cotton and rayon fabrics has resulted in the evolution of new fiber crosslinking agents and greater permanency. While here completely nonnitrogenous monomers and polymers are preferred, many nitrogenous products are generally satisfactory in many use conditions. The reactivity of some of the "wash-and-wear" finishing agents with the fibers is clear cut. In other instances both resin formation in and on the fibers and reaction with the fiber polymer are possible. In any case, improved durability has been obtained.

Many of the established homopolymers and copolymers of vinyl acetate, ethyl acrylate, methyl methacrylate, styrene-butadiene, etc, are receiving improved and unique properties by the introduction of functionally active groups so as to convert these normally thermoplastic polymers into thermoset polymers by the application of heat and catalysts. The more prominent groups capable of reacting with fibers or with themselves, which are being employed in reactive emulsion polymers, are those derived from glycidyl acrylates, vinyl glycidyl ethers, crotonaldehyde, acrylamide, acrylic acid, and formaldehyde adducts of some of these.

In the past, both chemical suppliers and textile plants have used empirical approaches to solve new finishing problems or to develop new effects on textile fabrics. This is well illustrated in all finishing fields, but primarily in the case of man-made fibers. Here the normal approach has been to make use of established finishing agents which were developed earlier for natural fibers. Only in recent years has the philosophy developed to engineer specific chemical products for individual fiber type, since each fiber has its own individual reactivity, accessibility, and adhesion for other materials. The results of scientific approaches here are demonstrated in such developments as specific acrylic polymer finishes for nylon and Dacron; thermosetting polyamine complexes as durable antistatic agents; styrene-maleic anhydride finishes for acetate; and the silicone finishes for fiber glass.

"Wash-and-wear" reactive resin monomers and polymers for cellulosics will continue to be the major preoccupation of both chemical companies and the textile industry for some time, since there is still need for major improvements in this field.

* A panel discussion held during the Dec 5, 1958 meeting of the Northern New England Section at the Hotel Vendome, Boston, Mass.

The idea of fiber reactivity of other products, such as emulsion polymers, water repellents, sizes, dyes, etc, will continue to spread in all textile quarters, and such sister industries as paper, wood and leather. Only recently has it been realized that many of the fiber-reactive textile finishing chemicals have identical or similar desirability for use in paper, wood and leather finishing with only minor modification of application conditions. This is especially true for some of the new cellulose crosslinking agents developed for cotton finishing and for many of the reactive emulsion polymers.

While many of the existing chemically reactive finishes for textiles are still based on formaldehyde reactivity, and are relatively low-cost products, the future will see greater development and utilization of monomers, polymers and resins based on epoxy, imine, isocyanate, acetal, vinyl, and ketene functionality to obtain unique and new textile properties.

VICTOR S FRANK: I should like to summarize very briefly some of the impressions that I gleaned in a very short time in recent weeks in Europe.

I have had the opportunity to meet with some European producers of a variety of polymers and to discuss with them some of the applications for their products.

At the outset, I should like to point out that I know a lot more about polymer chemistry than textile technology. Nevertheless, it was interesting for me to compare what I saw and heard of European practices with our own in the textile industry.

I have the strong impression, based on a limited and quick survey, that the art of processing fabrics, that is, especially the use of polymers in finishing, is considerably more advanced here than in most of Europe.

In continental Europe and in Great Britain, both the thermosetting and thermoplastic resins are used in fabric processing, in general, in much the same manner and for the same reasons that we use such materials.

The major applications in Europe do not yet include nonwoven fabrics, and only recently included backsizing of pile and tufted fabrics. This is just getting off the ground in European practice, and that is largely for the reason that a good deal of this kind of material is used in automotive fabrics, and they don't have such things in Europe. The seats are either leather or some less-stylish fabrics. They are not style-conscious in the matter of the European cars.

Finishes to improve the hand of a fabric, to provide more durable, wash-resistant and abrasion-resistant fabrics, are fairly large consumers of a variety of polymers, both thermosetting resins and thermoplastic resins, based on, in the case of thermosetting ones, the same kind of modified ureas and melamines, and in the case of thermoplastics, polyvinylacetates and others I will mention.

In some respects, a wide variety of thermoplastic materials is available, in the form of dispersions or latices or in the form of solutions. These include polymers and copolymers of acrylic esters, vinyl chloride, isobutylene, dichloroethylene, butadiene, styrene and acrylonitrile. Polymers based on vinyl ethers, as in America, have had so little application, not only in the textile field, that their manufacture has been discontinued.

One of the newer materials introduced in Germany is polyethyleneimine, available as a solution in water. Impregnation of cellulosic fabrics with polyethyleneimine has led to products with high tensile strength in the wet state, without impairing absorptivity and suppleness. This has been used in the European paper and cellophane industries for some time, again for high wet strength, and now the development of this chemical in the United States is under way.

One of the interesting and notable developments in European textile technology is the increasing use of vinyl acetate polymers and especially copolymers in finishing. The permanently flexible, internally plasticized vinyl acetate copolymers are compatible with a wide range of resins, softeners and other textile chemicals, much more so than the conventional polyvinylacetates.

Dispersions of vinyl acetate polymers, or what we commonly call emulsions, both of homopolymers and copolymers, are now being made with new kinds of emulsifying systems, eg, with cellulose derivatives. These have been introduced recently in Europe, and they are of interest because of their improved compatibility with starches, as well as for the increased stiffness provided by homopolymers made with such protective colloids.

Flexible vinyl acetate copolymers are being introduced where the more expensive acrylates have been used.

Other special dispersions of vinyl acetate polymers and copolymers have been developed with exceptionally small particle size, and have been applied where superior penetrating properties are required. Dr Perry is going to talk more about the importance of particle size later.

Special dispersions of such polymers have been developed also for impregnation of felts and furs; that is, for impregnating protein fibers, such as wool and hair. Still other modified vinyl acetate polymers have been introduced especially for the fixation of pigments used in textile printing.

In general, the same kind of techniques are used, and in some respects they are five to ten years behind the practice in this country.

As you perhaps know, polyvinyl alcohols are produced by the partial or complete saponification or alcoholysis of polyvinylacetates, and they are available in a variety of grades, depending upon molecular weight, degree of substitution, and now, the kind of substitution from vinyl acetate copolymers. These are now being introduced for special sizings, but again, a wider variety of polyvinyl alcohols is available in this country, rather than in Europe.

For those who are interested in seeing and handling samples of various European fabrics finished there in several different ways, I have samples of shirting material, "wash-and-wear" materials, lining materials, calicoes, rayons, and wool gabardines.

LLOYD H PERRY: Actually, the easiest and safest way to apply polymers to textiles is from solutions or dispersions of the desired polymers in water. Fortunately, this is also the easiest way to produce polymers. I thought that it might be interesting to discuss some of the aspects that have to do with the makeup of water-dispersed polymers. During my talk, I may refer to them as water-dispersed polymers, polymer latices, or polymer emulsions, as each means the same. I intend to emphasize particularly the emulsifying soaps and the size of the dispersed-polymer particles. Certainly the choice of polymer is important, but both the soaps and the size of particle go a long way toward determining how well a product will perform in a given application.

There are several ways by which polymers may be produced; bulk, solution, suspension and emulsion. By far the most commonly used is the emulsion process. This process is fast, easy to control, and it produces materials that are tough and have a high molecular weight. This is the one

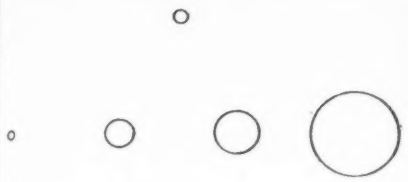

Figure 1
Comparative particle sizes

Top
1—Ubatol U-20001 (0.03 micron)
Bottom
2—Colloidal silica (0.02 micron)
3—Dry-bright wax (0.07 micron)
4—Polystyrene latex (0.1 micron)
5—SBR latex (0.2 micron)

used for the preparation of the common styrene-butadiene latices and the polyacrylate latices, with which most of you are familiar.

In the preparation of a polymer latex, the monomer (or mixture of monomers if a copolymer is being made) is stirred into water containing soap to form an emulsion. To this monomer emulsion is added the catalyst, and the polymerization is carried out at the desired temperature. During the polymerization, the monomer migrates from the emulsified particles and reforms itself around soap micelles. These are the actual particles in the vinyl polymer latices. You might think of the polymer emulsions as being formed chemically. In this way, you achieve greater stability than you would merely by emulsifying them. As you can sense, the soap is a mighty important ingredient in polymerization. For it to perform well, relatively large amounts of the soap usually are used.

For the past ten years or so, the textile industry has used large quantities of styrene-butadiene latices for the preparation of what I term "passable" upholstery backing compounds. I say "passable" because their use has posed problems, whenever it was desired to pass these backed fabrics through the dyeing operation. One of the reasons for this trouble is the presence of the soap. In the common styrene-butadiene latex, for example, better than four percent soap, based on the weight of the polymer, is normally used. In the styrene-butadiene latex that has been most widely used, ie, Type 2,000, the soap is a sodium salt of a rosin acid, which is very water-sensitive. The presence of this water-sensitive soap, plus the relatively mild vulcanization conditions which one is forced to use in curing the rubber film on the fabric, make it almost impossible to build up a really high degree of water resistance.

During the past few years, there

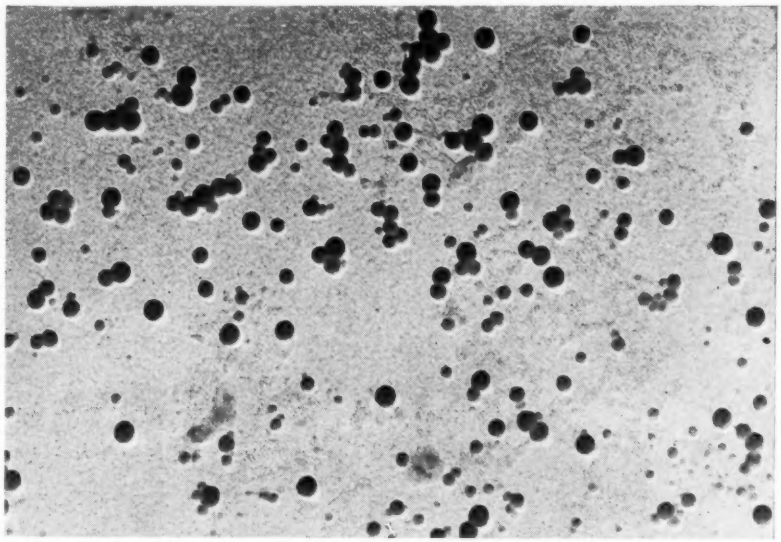

Figure 2
U-2001 Ubatol
(50,000X)

has been a trend toward the preparation of latices containing less-water-sensitive soaps. Examples of such soaps are the nonionics, with limited numbers of polar groups, and anionics, which are neutralized with volatile amines. When the latter type of soap is heated, the amine splits off and the remaining acid portion of the soap has a much improved resistance to water.

For the best results with compounds of this type, one must be careful in compounding. For example, the pigment slurries that are going to be used should be dispersed in water-resistant materials, and care should be taken to avoid such thickeners as the natural water-soluble gums and the common sodium polyacrylates. There are problems which arise in the production of these polymers with the more water-resistant soaps, but such products are showing up for other uses and will certainly be available for textiles before too long, if some haven't been adapted already.

I would like now to mention briefly the size of the polymer particles, another area where considerable work is being done.

A whole new market for the commonplace polystyrene latices in floor waxes has been created merely by reducing the particle size of the material in the water. The choice of the soap is important here, also, but the principal improvement has been the reduction in the size of the particles. With these smaller particles, polystyrene latex has become an excellent ingredient for water-base floor waxes, which, I might add, don't contain very much wax any more. There are possibilities also for this type of material in textile applications.

Figure 1 illustrates what I mean by a small particle size. In the upper part of the illustration is a circle, which represents a typical small particle size polystyrene latex, eg, Ubatol U-2001. On the lower part of the illustration is shown the comparative particle size in a colloidal silica dispersion, a dry-bright wax, a normal polystyrene latex, and an SBR type latex. On comparing these, it becomes obvious why we are able to use the Ubatol U-2001 successfully in floor waxes. When the right particle size is combined with the clarity, color and high refractive index of the polystyrene, an excellent material for a floor wax is produced.

Another comparison is of direct interest to those in the textile industry. According to my calculations, a cotton fiber has a diameter of approximately 10 microns. The small particle size polystyrene has a diameter of 0.05 microns, or approximately $\frac{1}{200}$ the size of the cotton fiber diameter.

One obvious application for polymers of this small particle size is their use on fabrics to render them more soil resistant. We have investigated this in our laboratory, and I want to show you some of the results we achieved with an electron microscope.

Figure 2 shows a small particle size polymer latex in the range of 0.03 to 0.05 micron. You will note that the particles are spherical in shape and fairly uniform in size.

Figure 3
Cotton fiber, untreated, soiled, vacuumed

Figure 4
Cotton fiber, treated, soiled, vacuumed

Figure 3 shows a cotton fiber that was taken from a rug, one half of which had been soiled by traffic and vacuumed. The fiber was examined in an electron microscope. You will note the large, irregular-shaped black mass in the upper part of Figure 3. This is a particle of dirt which adhered to the fiber so well that it was not removed by vacuuming. There are also other smaller ones, and I might add that every fiber we looked at from this half of the rug had the same kind of appearance.

Figure 4 is a picture of a fiber taken from the other half of the same rug. This half was treated beforehand with a one percent emulsion of polymer. You will note that there are no large dirt particles and that there is distinct evidence of the small particles of polymer adhering to the sides of the fiber. The magnification in this photo is forty percent that of the polymer dispersion itself. I think it is obvious that there are polymer particles on this fiber.

Colloidal silica dispersions have been used commercially for antisoil treatment. Theoretically, polymers should be even more adaptable for such applications. They can certainly be modified to give any degree of hardness and are longer lasting because they can be made to adhere to the fibers better. In short, I believe that here is a chance to really tailor-make a material for use on the fibers.

There are other uses in textiles for this sort of material. For example, in the spinning of fibers to produce yarns, there is a need for pretreatment of the fibers.

Let me summarize briefly by saying that the choice of a polymer is certainly important; but the way this polymer is dispersed, or, in other words, its colloidal properties, also go a long way toward determining how well a polymer latex will perform in a given application.

HERMAN F MARK: The previous speakers have covered the field so well that all that is left for me to offer is a general survey, including not only what is being used now and what is presently available, but more what trends now exist in polymer chemistry, and what we can expect to be useful in the near future to meet the problems which we are discussing tonight. Most materials which have been mentioned until now have been in the focus of interest of polymer chemistry five, six or ten years before they have become ready for practical textile application. Therefore, the question arises: Are there any things now brewing in some areas of polymer chemistry, which could some day become important? It seems indeed that there are a few such topics.

One is the growing capacity to carry out very rapid addition polymerization reactions. As our last speaker has explained to us, diffusion is very important in order to get the resinous material as intimately connected with the fiber, yarn or fabric as possible. Rapid diffusion can be achieved by the use of a very small particle size emulsion. It can also be done by the use of resin formers, which are added as small molecules and are polymerized in the course of the application. In most such cases, combination reactions have been used in the past, which are relatively slow and which encompass the use of phenol, urea, melamine, formaldehyde and similar ingredients.

In general, one has not yet applied vinyl- or acrylic-type monomers to the treatment of yarns or fabrics. Why? Because their polymerization was too slow.

Now, with the aid of new catalysts, however, and with the aid of new types of acrylics and vinyls, one can carry out addition polymerizations in fractions of a second to essential completion. Hence it is perfectly possible to swell cotton or rayon with one of these monomers and either by irradiation with light or by action of a catalyst, to polymerize this monomer onto the fiber in a very short period.

It has often been asked: Will there be at the end of the curing period a true chemical combination between the new polymer, whatever it may be, and the fiber? The answer is this: Whether or not there is a true bonding, there is, in any event, a very strong entanglement between the original polymeric system and the new polymer, which penetrates the fiber in molecular dimension and remains permanently connected with it.

Such processes are called "grafting" of a polymer onto a fiber or a film and they provide a very firm and permanent connection of the two components.

At present, several rapid polymerization reactions have been studied in the vinyl and acrylic field and I would like to pose the question for discussion: When and under what conditions would it be possible to capitalize on them for the treatment of fabrics?

Another area of recent development is the use of functional groups other than formaldehyde, such as ethylene oxide, propylene oxide and other epoxy compounds.

Another very reactive and rather interesting group of substances is replacing the oxygen by an NH-group. This ethyleneimine ring opens rapidly, with certain catalysts, and reacts with the surface of the fiber essentially through the two valences, which are put in freedom by the opening of the ring.

For certain applications, the NH ring may even be preferable to the oxygen ring, because we introduce here reactive hydrogen with a certain basic character, which introduces affinity to acid dyestuffs.

Other systems are also being studied, which, instead of three incumbent rings, contain four or five incumbent cyclic structures; representative of these groups are butyrolacton and anhydrolactam. These rings also open under the influence of certain catalysts and the molecule attaches itself to the surface of the fiber.

Still another group which provides chemical bonding of a polymer to a fiber is the isocyanate group, which is very reactive even at low temperatures and under very . . . .conditions.

The NCO-group attaches itself chemically to such groups as OH, NH_2 and COOH and forms strong and permanent bonds.

In the USA and in Germany, a large number of isocyanates of various degrees of reactivity have been developed and are now available for use in the textile field.

Right now the most important application of diisocyanates is in the preparation of block copolymers. In order to obtain such block copolymers, one has to prepare first segments of 1500 to 2000 molecular weight, with well-controlled and well-defined reactivities at each end. These segments or blocks are then "expanded" with the aid of bifunctional small molecules which react readily with the end groups.

The third point I want to make is the fact that stereo-regulated polymers, which, at the beginning, have only been available in the field of olefin polymers, can now also be considered in the entire vinyl and acrylic field.

QUESTION AND ANSWER PERIOD

Question: Dr Mark, you said something about the application to clothing, or the like.

Dr Mark: Yes. For instance, if one wanted to fasten, let us say, an antistatic agent or an adhesive on a fiber in a chemical fashion, this can be done by using an isocyanate group. This group reacts with the hydroxyl groups of cellulose, for instance, in such a manner that a firm, chemical bond is established. By this chemical bond, the rest of the molecule, which may contain hydroxyl groups or long aliphatic chains in order to be a lubricant, is fastened on the fiber permanently.

Q: Are the stereo-specific catalysts going to be of use in the field outside the vinyls, polyethylenes, etc, with some of the regulated fibers that we are producing today to improve their properties?

Dr Mark: At present, the different types of Ziegler catalysts or other stereo-regulating catalysts refer essentially to vinyl-type polymerization.

In the case of condensation polymers, the normal products of this type don't need any stereo-regulation, because they are polymerized so cautiously and slowly that they are regulated anyway.

Q: Dr Perry, in view of the fact that the small particle size polystyrene is quite similar in size to the colloidal silica, are there any implications for the material in fiber-spinning auxiliaries or spinning operations in general?

Dr Perry: The use of the small particle size polymers as an aid to spinning is certainly a very strong possibility. They could be very valuable, and there is some early indication in our work that they can be used to great advantage here.

Q: Mr Gagliardi, you mentioned that a number of problems still remain in the "wash-and-wear" resins. Could you brief us on what remains to be done?

Mr Gagliardi: One of the most important is the matter of durability to multiple launderings.

Equally important is the matter of producing "wash-and-wear" effects on cotton fabric without reducing any of the desirable mechanical properties of the original material. This has not been accomplished by any known method of crosslinking, resin finishing, or coating application.

Another problem involved with available materials is the matter of economics. Most of you know that there are available new crosslinking agents for cellulose, which, from an economic point of view, are very exotic and very expensive, but from the chemical point of view, are simple materials. This is especially true of the newer nonnitrogenous resins and crosslinking agents, such as the epoxies. It is unfortunate that the cost of these products cannot be tolerated. Therefore, the third major problem calls for continual search for low-cost crosslinking agents for cellulose, combining all the new desirable properties and not changing any of the natural properties of cotton fibers.

Dr Mark: Butyl lactone is a cheap material. Has it been used?

Mr Gagliardi: Monofunctional lactones have been reacted with fibers.

I don't know of any case where a difunctional lactone has been used for the purpose of crosslinking.

Dr Mark: Probably, right now, the isocyanates and others are too expensive for such applications. But that situation may not last very long, because intrinsically they must not be expensive. As soon as the productive capacity is on a higher level, they will certainly come down in price.

Mr Gagliardi: One of the things that is very important to remember is that many of the fiber reactions of the chemical groups discussed have been known since the turn of the century. What has not been available is the right chemical constituent, ie, the right specific practical organic compound.

For example, many of you may remember, from elementary organic chemistry, the statement that ketenes are supposed to be completely unstable in water! Also, isocyanates cannot be handled in water! While these statements are generally true, there are selected chemicals in such classes which *can* tolerate water. Work is going on in expolring these, as Dr Mark has explained, and some products are becoming available for textile finishing.

Q: Are there any polymers which have active groups for reacting with cotton, which can be applied to cotton by exhaustion techniques rather than padding?

Mr Gagliardi: There are such materials available, mostly in the form of cationic polymers which have a positive charge so that they will exhaust on anionic fiber substances. Such materials are first exhausted and then, by the application of heat, they can be reacted with the fibers or can be converted to thermoset resins.

This is a daily practice in the paper industry for wet-strength papers. Its only applications in the textile industry have been in the finishing of cotton with acid colloids of melamines (cationic polymers) and the after-treatment of direct-dyed fabrics with reactive, cationic, resinous dyefixing agents based on dicyandiamide-formaldehyde products. These can be exhausted and then cured by heat.

Q: Dr Frank, you stated that the Europeans seem to have a greater variety of resins, but that they don't seem to get them into practical use. What is the reason for that?

Dr Frank: I am not sure I know the reason for it. But you must remember that it takes a long time to recover from a war, such as Europe went through not too long ago. I am pretty sure that is probably the biggest reason for it.

They do have a variety of polymers that, in general, are similar to the kinds of things available here. But a few things are different.

Q: Isn't it true that many of ours stem from German techniques?

Dr Frank: Almost all of them did originally; that is right.

Q: We seem to get them moving in many, many carloads, while they are still working on them.

Dr Frank: Don't misunderstand. Some producers have polyvinyl acetates; for example, those in Germany. One in particular is the largest supplier in the world. But these materials go into things other than textile applications.

I think that the only reason is a slow recovery from the holocaust they went through some years ago.

Q: Dr Perry, in the electro micrograph you showed styrene particles on cotton, and you pointed out the individual styrene particles. I had the impression that the surface of the cotton fibers was only to a small fraction covered by particles.

Now, if you have a 0.03 micron particle and a 10 micron fiber, it is easy to calculate that a material with $\frac{1}{10}$ of one percent solids in it would more than completely cover the fiber.

Dr Perry: We have done no calculations of this sort. It certainly is an interesting area to look into. The particular rug from which these fibers were taken was treated with a material which had one percent solids in it.

Q: That would give more than complete coverage. As a matter of fact, you would expect five to ten layers of the styrene particles, which is average if they are uniform and of uniform distribution.

Dr Perry: In this case, we were interested in seeing if we could determine any difference between the fibers of a rug which had been treated and those of one that was not treated. I am sure we were quite wasteful of our polymer in the way it was applied to the finished rug. A better way to do it would be to apply the polymer to the individual fibers and then investigate them under the electron microscope.

Q: Mr Gagliardi, what is the difference between triazone and triazine?

Mr Gagliardi: The right name for the chemical structure loosely called the "triazone" is perhydroketotriazine. The "triazine" has no keto group. Both are reacted with formaldehyde to make them thermosetting and reactive with fibers. Both are chlorine-resistant resins.

Q: Mr Gagliardi, is chlorine a factor in the weakening of the fiber by "wash-and-wear" resins?

Mr Gagliardi: This problem has been noted historically in the treatment of cotton and rayons with nitrogenous thermosetting resins. Many such resins react with chlorine in bleaching to form chloramines. When later heated, the chloramines decompose to liberate acid and oxidants which destroy the cellulose or weaken it. All nitrogen-containing chemical finishes are potentially chlorine-retentive. Those containing tertiary nitrogen groups (completely alkylated) are most resistant to chlorine. Of these, the triazones have produced the least damage in bleaching because of the acid-combining capacity of the triazone ring.

The really permanent solution to the chlorine problem can only come about by the use of nonnitrogenous crosslinking agents or compounds, which have no capability for reacting with chlorine in a bleaching operation. Theoretically, there is a large number of organic compounds not based on nitrogen which can be made to react with cellulose. One of the earliest is the ketone-aldehyde resin class. While it produces the effect of being undamaged by chlorine, this generic class is worthless for practical application because of a number of properties, such as discoloration, yellowing or aging, and very poor crease resistance, on cotton and rayon.

A second group of nonnitrogenous compounds has been investigated, which covers various para-substituted phenol-formaldehyde monomers. While light in initial color, these produce colored cloth on aging or on change in acidity and alkalinity of the cloth.

The third major group of materials available for reaction with hydroxyl groups in cellulose comprises those containing epoxy groups. While still very expensive, these are being used today for finishing white fabrics, since they are completely chlorine-resistant.

A class of reactive bis quaternaries has been developed. These yield a nonnitrogenous finish when cured and washed. But too much of the molecule is lost in curing, so that such

(concluded on page 49)

Washington Section———

ACETATE—A BASIC FIBER FOR NONWOVENS*

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INTRODUCTION

THE arena was quiet, the gladiators stood in their corners, the audience leaned forward expectantly, and the battle between the wovens and the nonwovens was about to start.

Corny isn't it? Yet many people think that this is real.

Is it this simple? Is one about to displace the other? Will a new industry take its place with textiles, paper, and plastics substituting for a little bit of each or expanding the total usage for fibers?

To get a realistic answer, five questions will be discussed:

1) Why should nonwovens be made at all?
2) How are nonwovens made and how do they compete with or supplement manufacturing of textiles and paper?
3) What about fibers?
4) What are the most successful nonwovens today?
5) Where will the industry go from here?

1) WHY SHOULD NONWOVENS BE MADE AT ALL?

Today, per capita consumption of fiber in the United States is 35 pounds total per person. Economists believe that one hundred years from now this may be up as high as 44 pounds per person per year. One look at the dollars required to convert a pound of fibers into a pound of end-use items leads to the conclusion that in 2058 AD it is doubtful that anyone will be able to afford the 44 pounds of textiles per person predicted. Look at this another way: The conversion from fiber to end-use item represents "X" units of labor. This means there must be a 25% increase in total production. Economists say that the available man hours per man in the labor force will go down as a result of a shorter work week and the generally higher standard of living. Where then can these man hours come from? The obvious answer is that the processes must become more highly automated. Methods must be developed to insure higher productivity for the manual work available. Past history indicates that mass production, and its corrollary, less flexibility with fewer varieties, are inescapable in the future.

When the long, complicated assembly of fibers into yarn and yarn into fabric with its attendant winding and rewinding operations and the six million yarn crossovers per yard (ie, the present methods for producing woven fabrics) is compared with those used for nonwovens, the differences are apparent.

Floor space is expensive to obtain and to maintain. The area taken by a cotton opener, card, drawing frames, rovers, spinning frames, warping equipment, sizing equipment, drawing-in frames, pirn winders, twisters and looms is many times that taken by openers, web-forming equipment, saturators or spray ranges and dryers. Think of the specialists a textile mill must have—spinners, machine fixers, enterers, loom fixers, and weavers in comparison with the three or four people needed to operate a nonwoven line.

The beginnings of results of this are seen either by the utilization of nonwovens in place of textile materials or by the substitution of plastic films and paper for previous textile items—but the end of it isn't in sight.

This does not mean that the nonwoven process *per se* is less expensive than taking staple and converting it into yarn and this yarn (or filament yarn) into fabric. Indeed, one is hard put to demonstrate an economic advantage for most nonwovens with their woven counterpart. Statistics for selected similar items shipped in 1954 indicate the cost per pound for items competing with nonwovens were:

Nonwovens	$ .76 to $1.20
Woven Cotton	.80
Knit Fabrics	1.30
Paper Products	.09

Related to this is the time involved: From the time a fiber is first put into the hopper of an opener until it emerges as woven fabric may be three to six weeks. In a nonwoven operation this conversion takes place in the matter of an hour or so. This indicates the difference in production flexibility for the two operations. Look then also at the money tied up in fiber and yarn in process in the case of a weaving mill.

It is easy to be misled or become too enthusiastic and assume that these are sufficient reasons for nonwovens to completely replace the traditional textile materials. The price differential is not sufficient as discussed above. While it is true that in an individual operation the plant can shift from one item to another in a matter of minutes, it is also true that nonwovens are more like each other than woven fabrics. It must also be remembered that the traditional concepts of hand, drape, pattern, surface texture, and other aesthetic characteristics of woven fabrics are deeply ingrained in the mind of the public and that acceptance of alternates, which in many cases are not as artistically put together, may be a difficult and long-time proposition. The art of making woven textiles is highly developed and performance characteristics are wonderfully suited to clothing men, women, and children. The woven textile industry will not take such inroads sitting down but develop its own methods for combating this threat.

Another approach is to discuss the primary places for the utilization of nonwoven fabric. That is, the applications where, by judicious application of known processing methods and performance characteristics, nonwoven fabrics will better satisfy the end-use requirements than a comparable woven structure.

In the August, 1956 *Textile Organon*, the following manufacturers were listed "important"; that is, they have committed themselves to the expenditures needed to produce nonwovens: American Felt Co, Avondale Mills, Dexter Paper Company, The Felters Company, Johnson & Johnson, Kendall Mills, Minnesota Mining & Mfg Co, Pellon Corp, Stearns &

* Presented before the Washington Section on December 5, 1958

Foster, Steralen Products, and West Point Mfg Co. Since that date, this list would be changed only slightly by the addition of Callaway Mills and Gustin-Bacon to account for 80-90% of all nonwoven output. Later in this paper such applications will be discussed in some detail and the reasons why they have been successful will be decided. Howard E Shearer of American Viscose Corp provided *Textile Organon* with the consumption data shown in Table I, which demonstrates very forcibly that many of these nonwovens are sold.

2) HOW ARE NONWOVENS MADE?

Literature is full of descriptions of this and no attempt will be made to go into the details of equipment used. I call your attention in particular to Howard Shearer's articles in the November and December, 1958 issues of *Modern Textiles Magazine*, which are replete in detail.

There are, of course, several basic methods, most of which assume that fibers are handled and arrayed in some sort of a batting or web. An exception to this is the Arthur D Little—American Viscose development.

Two general types of equipment have been useful for web formation: 1) garnets or modified cards, and 2) random web equipment.

The former started out as a way of using waste fiber swept up from the floor or otherwise unsuitable for woven fabrics. A cotton mill might have seven to 10 percent waste as a result of its normal textile operations and look for means of converting this into a product which would command a higher price on the general market than the cotton waste market would support. Numerous illustrations are common knowledge and many articles have been written in the popular press showing the change from this type of an operation into the use of virgin fiber.

The second type of web-forming equipment, which is rapidly going into large-scale usage, is the Rando feeder and Rando webber manufactured by the Curlator Company. Figure 1 illustrates the flow of fiber through this equipment.

There is a third type of equipment reported in the literature and capable of making a nonwoven by sewing several layers on a special machine. This produces a batting-type insulator extremely useful for certain end uses. Figure 2 diagrams this. There are many modifications possible, such as cross lapping, air doffing from the doffer roll of a modified card, air doffing directly from the card cylinder, and these details are of real interest to mechanical engineers. It must be emphasized, however, that while individual mills and producers of nonwoven fabric have gone to considerable time and trouble to improve their own process, the industry as a whole is still not satisfied with the equipment used. A great opportunity exists for forward-looking machine manufacturers who are willing to take the necessary risk capital and invest it in the future. This risk is great, but if the assumptions made are correct the rewards will be cor-

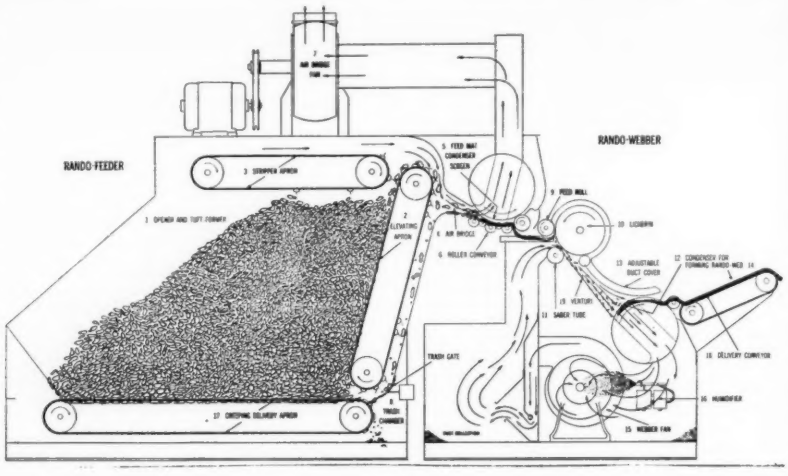

Figure 1
Schematic flow diagram, combined Rando-Feeder and Rando-Webber

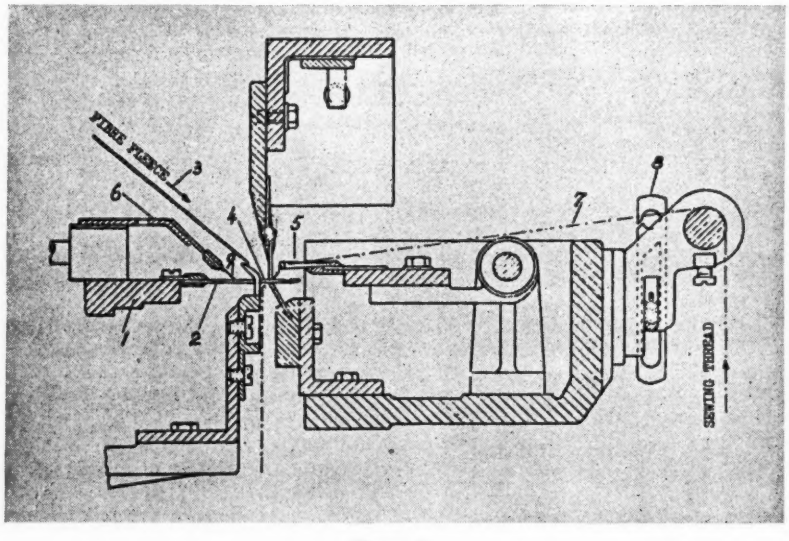

Figure 2

TABLE I
Estimated use of fibers in nonwoven textiles
Millions of pounds annual rate

Use	*Rayon*	*Acetate*	*Cotton*	*Other**	*Total*
Low-end industrial (padding, wiping, pressed felt, etc)	5.0	2.5	15.0	2.5	25.0
High-end industrial (towels, laminates, filters, coated fabrics, etc)	7.5	2.5	12.5	2.5	25.0
Household (draperies, table covers, sanitary products, etc)	12.0	3.0	4.0	1.0	20.0
Apparel (shoe fabrics, liners, ribbons, etc)	4.5	1.5	1.0	3.0	10.0
Total	29.0	9.5	32.5	9.0	80.0

*Mainly nylon & Dacron plus some wool.

respondingly high to these pioneers.

The second main step in the manufacturing process consists of taking a web and providing it with strength by mechanical or chemical means or the combination of both.

The original method of mechanically bonding fibers was the needle loom. This was done by taking a web formed on any equipment, subjecting it to the vertical action of small needles containing barbs, and utilizing the entanglement of these fibers to provide mechanical strength. Needle looms are quite old, but have undergone continuous mechanical development. and the modern loom is quite suitable for a production line. In a sense, needling can be considered to be the counterpart of wool felting so necessary in the creation of strong wool felts. The three-dimensional webs formed are useful as batting material and as a base for additional bonding operations. In some cases scrims are used as a base and the nonwoven needled into it yielding a fabric with the stability and strength of the scrim base and softness and loft of the applied and needled fiber.

The second method of production, or perhaps we should say conversion from a nonwoven batt into end-use product, is by spray-application technique. The binder is applied in the form of a fine spray to one side of the fabric, then conveyed on a belt through a dryer and either wound up or cut into pads. There have been a number of methods devised for spraying both sides of the nonwoven. Usually this is done by passing the sprayed material once through the dryer to dry the surface coat but not necessarily cure, then reversing the fabric, respraying, and subjecting this assembly to a final curing operation.

The third method, and the one which led to the first commercially useful products, is the saturation technique, where the entire nonwoven is dipped into a solution of the bonding agent, passed through squeeze rolls, and finally into a dryer to remove the water and complete the cure. Rodney Hunt Machine Company has a saturator unit on the market which field reports indicate is quite good.

Each of these three types of products will have some characteristics which are related to the method of production in addition to the fiber and binder properties.

Needled webs by their very nature will be soft and lofty, and unless reinforcing scrims are used, relatively low in physical strength. Examples of commercial applications are: plastic backing, personal products, filter fabrics, and insulation.

Sprayed batts will be lofty and retain their thickness well. While their strength will depend on fiber characteristics as well as on the physical properties of the bonding agent, the retention of loft and recovery will be largely determined by the binder. These articles have become an item of commerce and may be found in numerous products, such as air filters, wiping cloths, towelings, masks, rug backings, and wall coverings.

Saturated nonwovens approach saturated felts, paper-like, and leather-like products more closely than sprayed or needled products. The amount and type of binder has an important effect on physical characteristics. The strength in most cases is determined more by the bonding agent than by the fiber.

Saturated nonwovens appear in many end uses, such as shoe uppers and liners, curtains and draperies, interlinings, napkins and tea bags.

There are also patents on a foam-bonding technique, which, it is reported, is in commercial use abroad. The reputed advantages are a more lofty, open fabric, or in the words of the patent: ". . . preservation of the numerous relatively large interstices between the fibers . . ." and ". . . precipitation of the binder material on the fibers particularly at the crossing points between adjacent fibers" . . . "cementing them together at their crossing points without completely encasing the fibers or filling the interstices . . ." (US Patent 2,719,806—Nottebohm—assigned to Pellon Corp). This process, if fully successful, will represent a real step forward in bonding technology.

A closer look at the bonding agents themselves reveals that binders as such have two principal reasons for use. First, they bond the fiber together as by a cement or glue, and they weld the fibers to each other either by the use of a small amount of thermoplastic fiber or by the use of a plasticizing agent. The former is in more common usage by the nonwoven industry, while for specific applications, the latter may be preferred. This latter permits bonding to a relatively small area and spot welds one fiber to another. This gives a matrix having the properties of the individual fibers but greater cohesion and strength than is possible with a needled batt alone.

The cementing or gluing is by far the most common. It is in this area that the most rapid technical progress has been made in the recent past. The chemical companies have been exceedingly active in the development of special bonding agents for nonwovens and many have found large-scale usage. More than two hundred proprietary products, which fall generally into the categories of thermoplastic or thermosetting resins, are now available. Chemically they belong to more than a dozen different basic types which may be classified in three groups:

1) *Emulsions*—These are by far the most important and include a variety of chemically different products.
2) *Thermosetting and thermoplastic powders*—These are new but as methods of handling are developed will gain in importance.
3) *Solution-type binders*—These include solutions of starch, polyvinyl alcohol, and certain caesins. Solvent solutions of rubber or other latices could be used but do not seem to be practical due to the commercial hazards involved. The use of solvents and plasticizers in combination with thermoplastic fibers has been metioned.

Certain commercially important emulsions include: butadiene styrene, butadiene acrylonitrile, acrylic polymers, vinyl chloride polymers, vinyl copolymers, and polyvinyl acetates. In addition, binder formulations will include other materials in combination with these to enhance such properties as chemical resistance, light and heat stability, aging resistance, and improve properties related to the strength of the material. Common in this connection are urea-formaldehyde resins, phenol-formaldehyde, and other phenolics, melamine urea resins, chloride polymers and others. Of course, no binder formulation would be complete without some other components—to name a few: emulsifiers and stabilizers, catalysts and other materials to control polymerization, antioxidants, bacteriocides, and inhibitors for specific purposes. Tables have been prepared showing the major binders and applications for each. (See Tables II and III).

Mentioned above under equipment were two general methods of applying these binders. In addition to the continuous bonding possible on either spray ranges or saturation units, some producers of nonwovens feel that a discontinuous bonding in spots or stripes or other patterns give a product much closer to a woven fabric than is possible with continuous bonding. There are several products on the market to illustrate these.

TABLE II
List of typical nonwoven bonding agents

Type	*Tradename*	*Manufacturers*
Butadiene acrylonitrile	Chemigum 235 CHS, 247, 245 CHS Hycar 1571, 1577, 1551, 1552, 1562, 1561	Goodyear Tire & Rubber Co B F Goodrich Chemical Co
Butadiene styrene	Pliolite 2105, 101A, 160 Dow latexes 512K, 512R, 513K, 762W, 529K, 762K, 762L Hycar 2507	Goodyear Tire & Rubber Co B F Goodrich Chemical Co
Vinyl chloride & copolymers	Geon 576, 577, 352, 653, 251 Pliovic 300, 570 Dow latex 744B	B F Goodrich Chemical Co Goodyear Tire & Rubber Co Dow Chemical Co
Acrylic resins	Rhoplex B15, B-85-AC, 33, HA 159 Hycar 2600 X 30	Rohm and Haas Co B F Goodrich Chemical Co
Polyvinyl acetate	Celanese PVAc Cl-100, 102, 104, 201, 202	Celanese Corp of America
Phenolic resins	BRL 1583, 1100, 1929 Synco 358, 418LC, 550	Bakelite Co Synco Resins, Inc
Phenol & urea-formaldehyde resins	Durez 18663, Synsize 51 Catalin 843, 812	Durez Plastics, Synco Resins
Melamine resins	Acrotex M3, Resloom M75, Resloom HP, Resloom 840, Cymel 405S, Cymel 470	American Cyanamid Co & Monsanto Chemical Co
Modified urea resins	Catalin 849, 842, 8744 Rhonite R1 & R2	Catalin Corp & Rohm & Haas Co
Polyvinyl alcohol & starches	Lemol 5-88, 5-98 Clinton X-Gum, Clinton 60	Borden Co Clinton Corn Processing Co
Natural rubber latex	Natural rubber	Firestone Rubber Co General Latex Co

TABLE III
Bonding agents for various nonwoven products

Typical Bonding Agents	*Nonwoven End Uses*
Butadiene acrylonitrile Butadiene styrene	Interlinings, wiping cloths, mops, shoe innersoles, belt inserts, book bindings, luggage.
Acrylic resins	Interlinings, luggage fabrics, backings for reinforced plastics, outerwear applications.
Vinyl & polyvinyl acetates	Liquid filters, sanitary products, ribbons, diapers, quilted battings, rug backings, coated fabrics.
Vinyl & polyvinyl chlorides	Automotive side-door panelling, backing for vinyl upholstery, heat-scalable battings, quilted battings.
Phenolic resins	Insulation, soundproofing, lamp shades, filter binders.
Melamine resins	Crosslinking agents for other bonding agents, air and gas filtration.
Starches	Liquid filters, nonwoven products for electrical insulation.
Modified urea resins	Most commonly used in combination with other resins (acrylonitrile & acrylics) to improve washing and drycleaning properties and to modify hand.
Polyvinyl alcohol	Decorative ribbons, wrappings.
Phenol formaldehyde	Industrial batting (ie, insulation, packaging material, acoustical).
Natural rubber	Leather substitutes, snow linings, gasket materials.
Low melt thermoplastic fibers Example: Vinyon Dacron	Tea bags, ribbons, lens, cable wrappings, electrical insulation.

There has been publicity in connection with Chicopee Manufacturing Co's golf towels, which are of this type.

The bonding agent in many cases is the most expensive raw material in the nonwovens, ranging in price from 30 to 70 cents a pound on a dry basis. In most applications, the bonding agent will be not less than 20% nor more than 50% of the total weight. This area is certain to be a major development interest to the manufacturers of bonding agents.

3) WHAT ABOUT FIBERS?

This is a major concern to Celanese as a producer of fibers and, at the same time, is one of the simplest to analyze. Almost any fiber can be used to make nonwoven fabrics, and, as the previous consumption data showed, all are. Mention was made previously of the transition from waste fiber utilization to virgin fiber use by all branches of the industry. This merely means that the nonwoven industry is maturing at the present time. Fibers fall into two major classes based upon price, with the cellulosics much less expensive than the "true synthetics". The engineering of each end-use product will determine which fiber will be most suitable on a price-performance basis.

Before we look at each application individually, let us consider the properties of acetate fiber which make it useful. These are listed in Table IV.

Now to touch on the fourth question.

TABLE IV
Advantages of acetate for nonwovens

Low fiber cost
Ease of processing
Freedom from static problems
Good blending properties
Wide range of deniers
Variety of cross sections
Choice of luster (bright or dull)
Good binder compatability
Low specific gravity
Sunlight and age resistant
Moth resistant
Mildew resistant
Low moisture regain
Low shrinkage & swelling properties
Not affected by standard drycleaning solvents
Good dielectric strength
Good insulation values
Good acoustical values
Thermoplastic—can be solvent bonded

4) WHAT ARE SOME OF THE MOST SUCCESSFUL NONWOVENS TODAY?

Without apology, and not in order of importance, they are as follows:

1) Nonwoven backing for automative side door panels & seats.
2) Nonwoven backing for plastics and leathers.
3) Nonwoven fabric interlinings.
4) Nonwoven milk filters.
5) Nonwoven quilted structures.
6) Nonwoven industrial and residential air filters.
7) Nonwoven packaging materials.
8) Nonwoven stuffing for upholstery and furniture.

A brief outline analysis of each will be of real interest to those interested in this field.

1) NONWOVEN BACKING FOR AUTOMOTIVE SIDE DOOR PANELS & SEATS

(Estimated Fiber Consumption—5-8 million)

Bonded fiber constructions are currently used by many large automotive manufacturers as a sandwich material between the vinyl outer surface and the composite board backing in automotive door panelling.

Basic Construction

Oriented or random-laid man-made (primarily acetate and viscose) and natural fibers in bends are spray bonded by a vinyl type bonding agent.

Bonded fiber weights are 4.5—5.75 ounces per square yard.

Method of Manufacture

Standard nonwoven processing methods are used to produce the nonwoven batting. This batting is then heat sealed by dielectric means to the vinyl covering and board base

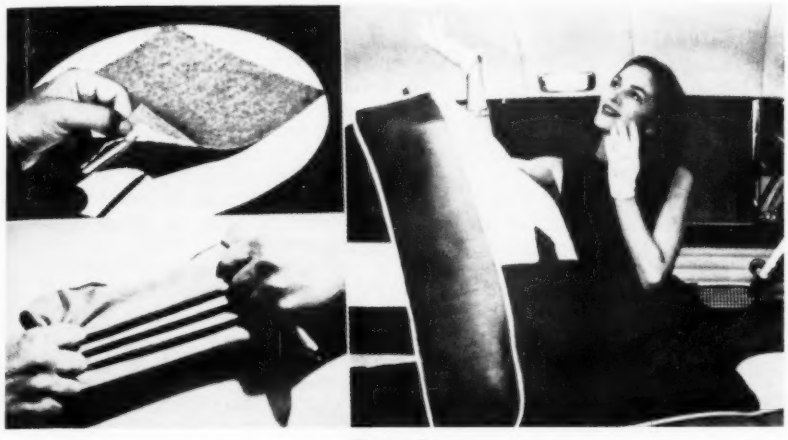

Figure 3
Upper left: Lantuck can be electronically sealed to vinyl film with wadding between for quilted effect.
Lower left: KnitKote shows high elasticity.
Right: Various fabrics back vinyl in headlining, upholstery, door panels and other parts of automobile interior trim.

at the automotive manufacturer's plant.

Reasons For Success

A) Ability to be heat sealed by dielectric means.
B) Gives the completed panel a rounded, third-dimensional effect because of the increased bulk of the nonwoven.
C) Greater flexibility in styling of embossed effect.
D) Provides padded effects otherwise not obtainable without nonwovens.
E) Well suited to high volume—low cost operation.

2) NONWOVEN BACKING FOR PLASTICS & LEATHERS

(Estimated Fiber Consumption—10-14 million)

Nonwoven fabrics have supplied a definite need as backing material for plastic and leather in the shoe, luggage, and handbag trade as well as certain military and industrial areas.

Basic Construction

A) Parallel, cross, or random-laid nylon, acetate, viscose, and cotton fibers spray bonded together with latices, resins, or natural rubber.
B) Weights range from a few ounces to approximately 10-12 ounces per square yard.
C) Thicknesses range as high as 80 mils.

Method of Manufacture

Basic webs produced on cards, garnets, or air-laying equipment followed by special bonding, laminating, and finishing techniques.

Reasons For Success

A) Serve as shape-retention media.
B) Reinforcement and supporting base for leather and plastics.
C) Provide bulk with low weight.
D) Greater abrasion durability brought about by resilient nature of the backing.
E) Greater styling flexibility.
F) Lighter weight products.

3) NONWOVEN FABRIC INTERLINING

(Estimated Fiber Consumption—5-8 million)

Nonwoven fabric interlining materials for men's, women's, and children's outerwear garments are firmly established in the garment field today.

Basic Construction

A) Cross-laid and random-laid nylon, rayon and acetate fibers saturated bonded together with latices, resins, or natural rubber. Isotropic in nature.
B) Weights range from approximately one to six ounces per square yard.
C) Thicknesses ranging from 10 to 25 mils.

Method of Manufacture

Basic webs produced on cards, garnets, or air-deposition equipment followed by special bonding, scouring, and finishing processes.

Reasons for Success Compared with Woven Interlinings

A) Give shape without weight—thinner.
B) Greater dimensional stability.
C) Resist crushing and distortion due to built-in recovery value.
D) Provide neater, flatter seams with 100 % seam strength.
E) Nonfraying at buttonholes or cut edge.
F) Can be cut in any direction, bias or otherwise.

4) NONWOVEN MILK FILTERS

(Estimated Consumption—2-3 million)

Nonwoven fabrics are now used almost exclusively for dairy farm milk filters.

Basic Construction

A) Parallel-laid fibers which have been bonded together with a nontoxic bonding agent to form both dense and lofty type materials.
B) Weight range from approximately 2.0 to 3.0 ounces per square yard.

Method of Manufacture

Parallel-laid fibers produced on a card or garnet followed by spray, roller coat, or saturation bonding. Frequently followed by calendering to give a smooth surface.

Reasons for Success Compared to Woven Cloth

A) Lower cost as a result of modern production, die cutting, and packaging methods.
B) More efficient contaminant removal.
C) High wet strength.
D) Higher production rate.
E) Engineered to meet special filtering conditions.

5) NONWOVEN QUILTED STRUCTURES

(Estimated Consumption—10 million)

Man-made fibers, such as acetate, have found wide acceptance in the quilted (sewn & unsewn) trade. Such items as housecoats, dusters, bedding, bedspreads, sleeping bags, and quilted interlinings for winter outerwear apparel contain cellulose acetate fibers to a large extent.

Basic Construction

A) Both air-laid and parallel-laid fiber constructions are used in bonded and unbonded form. Principal bonding agents used are the polyvinyls, acrylonitriles and acrylics. The greater proportion of material used is unbonded, some of which is laminated to a scrim cloth.
B) Batting weights range from 3.0 to 10.0 ounces per square yard.

Methods of Manufacture

Standard nonwoven processes are used to produce structures for this end use. Needled batts and spray-bonded fabric most common.

Reasons For Success (acetate)

A) Non-allergenic.
B) Mildew resistant.
C) Resistant to microbiological attack.
D) Acetate's whiteness and luster provide good background where fabric transparency is involved.
E) Quality product at low cost.

6) NONWOVEN COMMERCIAL, INDUSTRIAL, AND RESIDENTIAL AIR FILTERS

(Estimated Consumption—1-3 million)

Nonwoven fabrics and expanded bonded fiber constructions of several types have found their way into appropriate filtering applications. Some uses have been highly specialized with a limited market potential while others have provided sound markets involving several million units annually.

Basic Constructions & Manufacture

A wide variety of processing techniques are employed involving special air deposition processes as well as standard nonwoven textile equipment. This wide variation in basic construction stems from the fact that most filter applications are engineered for specific end use applications. Both unbonded and bonded constructions are employed while some applications require additional materials, such as diatomaceous earth, oils, or other filtering aids.

Reasons For Success (acetate)

A) Availability of different cross sections and a wide range of deniers allows greater flexibility in engineering constructions.
B) Economic advantages.
C) Low specific gravity—low density per cubic feet.
D) Ease of processing.

7) NONWOVEN PACKAGING MATERIALS

(Estimated Consumption—2-3 million)

Acetate fibers have been found to be most suitable for the packaging industry. This is due to the inherent quality of the fibers (free of contaminants, etc) as well as low cost.

Basic nonwoven constructions and methods of manufacture are standard throughout the industry.

Reasons For Success

A) Suitability to various processes.
B) Noncorrosive — highly resistant to mildew.
C) Low weight—high bulk.
D) Insulation value.
E) Good resistance to shock—does not powder or become brittle.
F) White color—free of odors.

8) NONWOVEN STUFFING FOR UPHOLSTERY & FURNITURE

(Estimated Consumption—3-5 million)

Acetate fibers are used in considerable quantity of padding or stuffing materials in the upholstery and furniture trade.

Basic Construction

A) Unbonded Battings
1) Used directly
2) Quilted to cheese cloth.
3) Quilted direct to upholstery.
4) Tufted direct to furniture cloth.
5) Used in conjunction with other materials, such as foams and spring units.

B) Blown Fibers
1) Acetate fibers blown directly into decorative pillows or furniture backing and tufted in place.

C) Weights
1) Battings range from 10-16 ounces per square yard.
2) Air-blown weights depend on size and shape of cavity being filled.

Method of Manufacture

A) In the case of battings, conventional textile processing equipment is used.
B) Blown fibers are usually handled directly from the bale.

Reasons For Success & Commercial Acceptance

A) Good resilience.
B) High compressional recovery.
C) Excellent resistance to rot, mildew—no odor problems.
D) Ease of handling and processing.
E) Low cost for virgin fiber.
F) Low moisture absorption.

5) WHERE DO WE GO FROM HERE?

That nonwovens will continue to grow is agreed to by everyone. The rate is somewhat in question but that is not a concern at this time. Rather, a few of the unanswered questions will be stated and examined and the orientation with our own personal interests determined. This would point toward the place each might take in the industry.

1) Are more new fibers required?

It is believed that the available fibers can be used to much greater advantage than they have been to date. Celanese produces acetate for low-price, high-volume uses and with the recently announced fiber, Teron, for the high-price, high-performance market, Celanese is looking forward to utilization at an ever-increasing rate.

2) Are new or better methods of web and batt formation needed?

Yes, as indicated earlier in this paper.

3) Are new and better binders needed?

The chemical companies and binder manufacturers are doing a splendid job. From their standpoint, the potential rewards are high, the work will continue, and the prices will be reduced.

4) Are new web-processing methods needed?

Very badly, particularly in the dyeing and finishing area. There has been encouraging news around the trade recently and combined with our own work it now seems possible to piece dye a large number of fabric types on conventional equipment.

5) How soon will there be real quantities of nonwoven outerwear in the market?

Ten years would be an educated guess.

6) In what direction will the market grow most rapidly?

Toward engineered products to fill specific needs.

The list of other questions which might be asked is longer than space limitations permit answering here. Current activity and sales will, in any case, give a better answer than can be foreseen.

BIBLIOGRAPHY

Abbenheim, P, "British and U S. Bonding Interests", *Silk and Rayon Rec*, 51-3 (Jan 1957)
Abbenheim, P, "Fleecy Nonwovens by Chain-stitch Technique", *ibid*, 966-9 (Sept 1957)
Abbenheim, P, "Nonwovens by Chain Stitch", *ibid*, 1312-3 (Dec 1957)
Anon, "A New Look for Nonwovens", *ibid*, 1310-1 (Dec 1957)
Anon, "A Special Report on Current Activities in the Field of Nonwoven Textiles", *Textile Bull*, 57-81 (Oct 1957)
Anon, "Bonded Fibre Fabrics", *Man-made Textiles*, 56-7 (Dec 1957)
Anon, "Bookbinding Fabrics Seen Promising for Nonwovens", *Daily News Record*, 24 (Oct 1, 1958)
Anon, Bulletin 104, Curlator Corp
Anon, "Discusses Production of Nonwovens by Rando-Web Process", *Am Textile Reptr*, 19-21, 65 (Mar 20, 1958)
Anon, "Fabrics Plus", Wellington-Sears Co, 1956
Anon, "Fibers Used in U S Nonwovens", *Textile Organon*, 132 (July 1958)
Anon, "Future of Nonwovens in Hands of Energetic Textile Producers", *Am Textile Reptr*, 87-90 (May 16, 1957)
Anon, "Goodyear Technical Fact Book", 56-135, Goodyear Tire & Rubber Co
Anon, "Goodyear Technical Fact Book", 56-219, Goodyear Tire & Rubber Co
Anon, "K-2000—A Nonwoven 'Paper' Fabric", *Cooperation*, Kimberly-Clark Corp, 1955.

Anon, "Launching Lantor", *Silk & Rayon Rec*, 1306-7 (Dec 1957)
Anon, "Nonwovens as Interfacings Spark Clothing Style Advances", *Am Textile Reptr*, 17-8, 42-3 (July 11, 1957)
Anon, "Nonwovens—Continental Applications", *Silk and Rayon Rec*, 301 (Mar 1957)
Anon, "Nonwovens Need Own Web, Bond Finish Machinery to Hit Target", *Am Textile Reptr* 9-10, 31-33 (April 3, 1958)
Anon, "Nonwovens Seen No Thread to Spun, Knit, Woven Goods", *ibid*, 11 (Mar 20, 1958)
Anon, "Proctor Automatic System", Proctor & Schwartz, Inc
Anon, "Producing Bonded Fibre Fabrics", *Silk and Rayon Rec*, 66-8 (Jan 1957)
Anon, "Proper Equipment Essential in Production of Nonwoven Fabrics", *Am Textile Reptr*, 31, 33, 60 (Mar 20, 1958)
Anon, "Report on Nonwoven Textiles and Plastic Laminates", *Textile Organon*, 123-5 (Aug 1956)
Boese, A W, "Bonded Fabric Development", Minnesota Mining & Mfg Co
Boggiss, Ivor W, "Performance, New Markets Held Nonwoven Growth Keys", *Daily News Record*, 17 (Sept 24, 1958)
Boyo, Gene, "Pellon", *Modern Textiles*, 61-2 (1945)
Brennan, W E, "Fibers and Equipment Used in Manufacture of Nonwoven Yarns", *Am Dyestuff Reptr*, 583-4 (Aug 12, 1957)
Buresh, Francis M, "High Loft Spray-bonded Nonwoven Fabrics", *Textile Bull*, 48-51 (Apr 1958)
Coke, C E, *Can Textile J* (June 29, 1956)
Cooper, Frank N, "Prescription for Textiles: Nonwovens", *Silk and Rayon Rec*, 405-6 (Apr 1958)
Donaldson, John P, "Patent Study Reveals Two New Fiber Forms", *The Little Acorn* (Winter 1957)
Dougherty, R W, and Eichen, H P (to Visking Corp), U S Pat 2,698,574 (Jan 4, 1955)
Drew, K R, "Nonwoven Gains in Europe", *Modern Textiles*, 42, 85 (June 1957)
Elliott, G H, "Bonded Fibre Fabrics", *J Textile Inst*, 737-41 (Nov 1955)
Elliott, G H, "Intrinsic Advantages of Bonded Fabrics", *Silk and Rayon Rec*, 60-4 (Jan 1957)
Emery, J R, "Synthetic Fibers in Nonwoven Fabrids", *ibid*, 275-6 (Mar 1958)
Fowles, G A, "New Textile Products from Plastics—Nonwoven Fabrics", *Am Dyestuff Reptr*, 326 (May 21, 1956)
Hoffman, Manfred T, "Nonwovens Up to Date", *Textile Inds*, 83-90 (May 1958)
Lang, P H (to American Felt Co), U S Pat 2,521,984 (Sept 12, 1950)
Lauterboch, H G, *Textile Research J*, 143-9 (Feb 1955)
Leventhal, H L, "Production and Utilization of Nonwoven Fabrics", *Am Dyestuff Reptr*, 464-6 (July 4, 1955)
Lovin, L G, and Wenzell, L P, "Technology of Nonwoven Fabrics", *ibid*, 326-8 (May 6, 1957)
Lynn, J Edward, "Nonwoven Fabric Volume Said to Double Every Three Years", *Daily News Record* 16 (Nov 14, 1957)
MacKay, Lamar, and Church, George, "Nonwoven Cloth Grabs Market in Drapes, Filters, Shoes, Lining", *Wall Street J* (Aug 20, 1957)
Mars, P A, "Nonwovens, Paper and Textiles in the USA", *Silk and Rayon Rec*, 401-2 (April 1958)
Mauresberger, Heinrich V, "Neues Verfahren zur Herstellung Nichtgewebter Stoffe", *Textil-Praxis*, 536-41 (June 1957)
Moffett, R P, "New Bonding Techniques", *Modern Textiles*, 62-5 (Oct 1956)
Nicely, D C, "Dyeing and Finishing Nonwoven Fabrics", *Silk and Rayon Rec*, 276-7 (Mar 1958)
Novak, L J (to Commonweath Engineering Co of Ohio), U S Pat 2,736,652 (Feb 28, 1956)
Phillips, J, and Payne, V L (to West Point Mfg Co), U S Pat 2,648,876 (Aug 18, 1955)
Pressley, Richard B, "Report on Nonwoven Fabrics", *Textile World*, 77-89 (Jan 1956)
Probasco, D V, "Processes, Problems, Predictions", *Modern Textiles*, 65-7 (Oct 1956)
Riehl, Harmon B, "Nonwoven Fabrics—The Machines That Make Them", *ibid*, 68-9 (Oct 1956)
Rudo, Stephen I, "Big Growth Seen for Nonwovens", *Modern Textiles*, 35, 77 (Apr 1958)
Rudo, Stephen I, "The Future of Nonwoven Fabrics", *Silk and Rayon Rec*, 275 (Mar 1958)
Sames, Herbert P, "Cardweb Nonwoven Process Seen Opening New Fields", *Daily News Record* (Aug 20, 1957)
Shearer, Howard E, "The Evolution of the Nonwoven Fabric Industry", *Modern Textiles* (Nov, Dec 1958)
Shearer, Howard E, "Nonwoven Fabrics", *Am Dyestuff Reptr*, 429-31 (July 7, 1952)
Stoll, R G, "Bonding Agents for Nonwoven Fabrics", *Silk and Rayon Rec*, 278 (Mar 1958)
Taylor, J T, "Nonwoven Fabrics—The Chemical and Processing Techniques", *Am Dyestuff Reptr*, 437-42 (June 17, 1957)
Walter, Leo, "Latex Impregnation for Nonwoven Fabrics", *Textile Bull*, 35-7 (June 1958)
Watkins, W W, "Nonwoven Fabrics—Their Status Today", *Modern Textiles*, 61, 67 (Oct 1956)
Wilson, C C, Cudd, H H, and Probasco, D V (to West Point Mfg Co), U S Pat 2,478,148 (Aug 2, 1949); U S Pat 2,477,675 (Aug 2, 1949)
Wrotnowski, Arthur C, "Nonwoven Filter Media", *Chem Eng Progress*, 313-9 (July 1957)

Polymers as Related to Fabric Processing

(*concluded from page 42*)

compounds are very inefficient for practical use.

In the case of nitrogen-based compounds, there are a number of practical processes in existence now, which are generally satisfactory for use on white bleachable fabrics. But these are not completely foolproof, since yellowing and strength loss can occur in excessive bleach.

Q: One of the points raised was the question of emulsion or emulsifying agents in the presence of certain thermoplastic materials used. I wish that this question of wetting agents or emulsifying agents in conjunction with materials which help to stabilize fabrics would be discussed. In some cases, it is obvious that they may not get in the way, but I feel that in many other cases they do.

I wonder if you can enlighten us on that.

Dr Perry: It has been our experience that extremely small amounts of water-sensitive emulsifier will have quite a degrading effect on any thermoplastic material with which it is used.

This can be overcome, for example, in a styrene butadiene rubber, by vulcanizing strongly. In so many of the applications where it is desirable to use latices, good vulcanization conditions aren't available. The strong vulcanizing agents cannot be used because they discolor badly. Very often, the materials that one wishes to vulcanize are put on a fabric which can't stand the high heat necessary for vulcanization. At best, you are working with something quite often difficult to cure. Generally, the amount of soaps that are used have a pretty strong effect on weakening the desirable properties.

I would like to throw out one thought here. I think that in a lot of work that has been done by polymer chemists in emulsion polymerizations, the soap has been treated as a necessary evil. Because of this they have worked with the soap that will let them make the prettiest emulsion, the most stable emulsion or what-have-you. I think the polymer chemist would be far better off if he treated this problem with a little bit of imagination and said to himself: "Are there any ingredients I would like to have in here that I could use as an emulsifier?" If they were to approach it that way, you might have products better for your ultimate use.

Dr Frank: I would like to add something and put in a pitch for my company. You may be interested in hearing that we have applied for a patent on making emulsion polymers, particularly of vinyl acetate and copolymers of vinyl acetate, without emulsifiers or protective colloids.

This sounds a little strange at first, but it isn't really, if you consider the mechanism by which emulsion polymers are made.

You first must form soap micelles, and this is where polymerization starts.

If you work with monomers which have a little solubility in water, then you don't need the micelles to start the polymerization. All you need is the right catalyst, which, in all cases of vinyl polymerization, ends up as end groups on the polymer chains; or if the right kind is chosen to stabilize these things and provide the right ionic material, such things may be made without emulsifiers at all.

We will be glad to give samples, if you will write in to us.

Q: Do the emulsifiers actually cause the polymers to become dislodged from fiber surfaces? What is their mechanism?

Dr Perry: The emulsifiers allow the water to permeate into the polymer itself, and then any sort of abrasion is able to dislodge this from the particle. It is more a case of weakening the polymers, so that they are easily abraded.

Actually, I mentioned the case of applying backings to upholstery fabrics. Some are so flimsy that nothing can be done to the fabrics until they get some rubber on the back of them.

Now this rubber film can withstand boiling water, for example, provided it is held still. In a dyeing operation, however, the fabric is tumbled, abraded and pushed around, and it doesn't take much of this at high temperatures to dislodge the rubber from the fabric. This is where the trouble begins, with a rubber full of water-sensitive soaps.

1959 AATCC NATIONAL CONVENTION

October 8, 9, 10 ● Hotels Sheraton-Park & Shoreham, Washington, D C

LOUIS R. MIZELL, treasurer of the 1959 National Convention, requests that checks for Convention Registration be made payable to "1959 AATCC Convention". Mr Mizell is with Harris Research Laboratories, Inc, 6220 Kansas Avenue, NE, Washington 11, DC.

LOUIS R MIZELL
Chairman
Finance Committee
1959 AATCC Convention

Elected to Membership[1]

[1] No designation after name indicates Senior
(A) indicates Associate
(J) indicates Junior
(S) indicates Student
*indicates transfer from another class of membership

April 23, 1959

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Joseph J Murphy
Rocco P Scalici

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Raymond J Prunier

PIEDMONT
Robert M Dameron*
Lawrence Hart
Ersel O Jones*
Clifton B Rhodes (J)
Wesley E Shields
Robert G Short (A)
Jack W Swiggett

RHODE ISLAND
Joseph H McCusker* (J)

SOUTHEASTERN
Zach S Cowan

WASHINGTON
Margaret T Goldsmith
Lane A Craig (A)

WESTERN NEW ENGLAND
Robert J Jackson

ALABAMA POLYTECHNIC INSTITUTE STUDENT CHAPTER
B J DeRing (S)

UNCLASSIFIED
Katsuji Nagatsu

May 26, 1959

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Roland E Ferron
Sebastian B Mecca*
Johne Parsley

MID-WEST
Ronald B Byersmith
Earl F Lienesch

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Jerome Miller
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NEW BEDFORD INSTITUTE OF TECHNOLOGY STUDENT CHAPTER
Norman A Metivier (S)

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Selahattin Gaffaroglu
Clarence E Robinson
Wallace H Robinson
Joerg H Sayle
Yum Shop Shim

AATCC Calendar

COUNCIL, COUNCIL COMMITTEES, RESEARCH COMMITTEES

Sept 9-11 (Hotel McAlpin, New York, NY); Sept 9—Research Committees; Sept 10—Council Committees, TCR, ECR; Sept 11 (AM)—Council Meeting

NATIONAL CONVENTIONS

Oct 8-10, 1959 (Sheraton Park and Shoreham Hotels, Washington, DC); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); September 28-30, 1961 (Buffalo, NY); 1962 (Southern Region)

HUDSON-MOHAWK SECTION

June 26 (Annual outing—Antlers Country Club, Amsterdam, NY)

METROPOLITAN SECTION

June 19 (Outing—North Jersey Country Club, Wayne, NJ)

MID-WEST SECTION

June 12-13 (Outing—Brown's Lake Resort, Burlington, Wis); Oct 24 (Bismarck Hotel, Chicago, Ill)

NIAGARA FRONTIER SECTION

June 12 (Annual Outing—St Catherines, Ont, Canada); Sept 25 (Niagara Falls, Ont, Canada); Dec 11 (Annual business meeting, Buffalo, NY)

NORTHERN NEW ENGLAND SECTION

Sept 18 (Outing—Wachusett Country Club, West Boylston, Mass); Oct 16 (Lexington Inn, Lexington, Mass); Dec 4 (Joint symposium with ASME Textile Engineering Div, Smith House, Cambridge, Mass); Jan 15 (Woodlawn Golf Club, Newton, Mass)

PIEDMONT SECTION

June 5-7 (Outing—Grove Park Inn, Asheville, NC); Sept 25-26 (Barringer Hotel, Charlotte, NC)

RHODE ISLAND SECTION

June 12 (26th Annual Outing, Metacomet CC); Sept 18 (Management Night); Oct 23 (Prov Eng Soc, Providence, RI); Dec 4 (Annual Meeting—Johnson's Hummocks Grille, Providence, RI)

SOUTH CENTRAL SECTION

June 26-27 (Outing—Riverside Hotel, Gatlinburg, Tenn); Sept 19 (Hotel Patten, Chattanooga, Tenn)

SOUTHEASTERN SECTION

June 12-14 (Summer Outing — Radium Springs, Ga); Sept 12 (Ida Cason Callaway Gardens, Pine Mtn, Ga); Dec 5 (Atlanta Athletic Club, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

June 12 (Outing — Wallingford, Conn); Sept 25 (Blake's Restaurant, Springfield, Mass); Oct 23 (Annual Meeting—Rapp's Restaurant, Shelton, Conn); Dec 4 (Hartford, Conn)

Membership Applications

DELAWARE VALLEY
Senior

John E Pretka—Research chemist, Textile Fibers Dept, E I duPont de Nemours & Co, Inc, Wilmington, Del. Sponsors: A G Scroggie, C A Sylvester.

Transfer (Student to Senior)

Earl S Dunlap Jr—Textile chemist, Lehigh Dyeing & Finishing Corp, Allentown, Pa. Sponsors: E S Dunlap Sr, E H Staab.

HUDSON-MOHAWK
Associate

Mason J White—Salesman, chemicals & dyestuffs, Ritter Chemical Co Inc, Amsterdam, NY.

METROPOLITAN
Senior

Charles E Rummel—Plant chemist, Poughkeepsie Finishing Corp, Paterson, NJ. Sponsors: J H Hennessey, G P Viegelmann.

Associate

Paul Margolin—Mgr, Syn-Tex Dyers, Allstate Dyers, Inc, Brooklyn, NY.

Stanley Kohlenberg—Account executive, L W Frohlich & Co, Inc, New York, NY.

MID-WEST
Senior

Donald G Brown—Foreman finishing, Munsingwear Inc, Minneapolis, Minn. Sponsors: G R Kremers, H A Sundeen.

Transfer (Associate to Senior)

Calvin W Seitz—Chemist, Rose Patch & Label Co, Grand Rapids, Mich. Sponsors: J G Templeton, J G Stott.

NORTHERN NEW ENGLAND
Associate

Joseph C McInerney—Lawyer, insurance broker & realtor, McInerney Insurance Agency, Inc, Lowell, Mass.

PIEDMONT
Senior

Richard L Herron—Chemist, Interchemical Corp, Rock Hill, SC. Sponsors: C S Powell, J H Emerson.

Richard C King—Sales, Moreland Chem Co, Greenville, SC. Sponsors: I S Hurd, W F Crowell Jr.

John T Reep—Head tricot dyer, Carter Fabrics, J P Stevens & Co, Inc, Wallace, NC. Sponsors: W R Sargent, L N Hurley.

Associate

Howard G Carpenter—Salesman, F H Ross & Co, Charlotte, NC.

William M Clark—Sales rep, Westvaco Chlor-Alkali Div, Food Machinery & Chem Corp, Charlotte, NC.

Transfer (Student to Senior)

Forrest F Schrum Jr—Chemist, Tennessee Eastman Co, Kingsport, Tenn. Sponsors: S E Shepard, R J Fortune.

Transfer (Associate to Senior)

Edward J Feeley II—Vice pres, E J Feeley Co, Charlotte, NC. Sponsors: C F Martin Jr, W F Crowell Jr.

Transfer (Junior to Senior)

Harold A Hedgecock—Dyeing & finishing trainee, Mooresville Mills, Mooresville, NC. Sponsors. V C Smith, C R Neal.

WASHINGTON
Senior

Richard H Laplante—Asst supt of dyeing, Crompton-Shenandoah Co, Waynesboro, Va. Sponsors: B C Bond, H Kinder.

Monroe Couper—Research supv, Orlon Research Division, Textile Fibers Dept, E I duPont de Nemours & Co, Inc, Waynesboro, Va. Sponsors: C F Chandler, A G Scroggie.

Transfer (Junior to Associate)

George H Lourigan—Textile chemist, Union Carbide Chem Co, Washington, D C.

STUDENT CHAPTERS

Thomas M Griffin—Student, Georgia Institute of Technology, Atlanta, Ga. Sponsor: W Postman.

Elizabeth C Price—Student, Alabama Polytechnic Institute, Auburn, Ala. Sponsor: J H Cox.

Wibowo—Student, Lowell Technological Institute, Lowell, Mass. Sponsor: G R Griffin.

UNCLASSIFIED
Senior

Alfredo Lustgarten—Head of dyehouse lab, Industria Nacional de Tejidos, Sedalana, Bogota, Colombia. Sponsor: A W Grunberg.

Cesar Manevich—Chem engr, Tejidos Leticia Ltda, Medellin, Colombia.

Associate

Mohammed A Jabbar—Stockist in imported textile chem & colors, Standard Dyes & Chemicals Co, Karachi, Pakistan.

Junior

Marcos Wasserman—Supv in finishing, Industria Nacional de Tejidos, Sedalana, Bogota, Colombia. Sponsors: G A Wallace, A W Grunberg.

Future Papers

THE following list is comprised of papers submitted to date for publication in future issues of the *Proceedings*. Authors and Technical Program Chairmen are requested to examine this list and call our attention to any omissions.

"Decorative Fabrics from Fibrous Materials"—Frank J Lachut, Owens-Corning Fiberglas Corp

"A Mild Cure Catalyst"—James B Irvine, Quaker Chemical Products Corp

"Mechanisms Influencing the Wash and Wear Characteristics of Cellulosic Fabrics"—C R Williams, Monsanto Chemical Co

"Fluorochemicals: The New Idea in Textiles"—Edwin J Grajeck and William H Peterson, Minnesota Mining & Mfg Co

"Blends of Polyfibers with Cotton. Advantages—Dyeing and Finishing Techniques"—Morton Santymire, E I duPont de Nemours & Co, Inc

"Probability of a California Textile Mill"—A C Hall, Mayor's Textile Committee for the Development of the Textile and Apparel Industries (Los Angeles)

"Synthetic and Natural Fiber and Yarn Processing Aids"—Charles H Lighthipe and Ralph G Schaubhut, Nopco Chemical Co

"Practical Experience with the Pad-Roll Dyeing Machine"—Robert M Lesh and Frank Percarpio, Northern Dyeing Corp; John S Thackrah, E I duPont de Nemours & Co, Inc

"Relation of Dye Structure to Properties of Disperse Dyes. 1) Anthraquinone Blues. 2) Diphenylamine Yellows"—V S Salvin and R A Walker, Celanese Corp of America

"Knit Goods of Orlon Acrylic Fiber—Processing and Dyeing"—G Robert Turner, E I duPont de Nemours & Co, Inc

Metropolitan

METROPOLITAN Section will hold its Annual Outing on June 19 at the North Jersey Country Club, Wayne, NJ.

Cochairmen for the event are Michael F Costello, Jacques Wolf & Co, and Chris W Farrell, Althouse Chemical Co. Assisting the cochairmen will be Eugene J Grady, Jacques Wolf & Co, tickets & resverations; Richard P Monsaert Jr, American Felt Co, publicity; Gerard Heine, Koppers Co, reception; and D G Zachary, American Cyanamid Co, golf.

Golf and swimming will be the featured activities at the Club.

As in the past, a buffet luncheon will be served at noon. Prizes will be awarded in the evening immediately following the roast beef or lobster dinner.

* * *

The Section held its Ladies Night program on May 15 at The Cliftonia Restaurant, Clifton, NJ. Highlights of the evening included a Smorgasbord dinner; a showing of a color film "Nepal, Kingdom in the Sky"; presentation of Service Award Certificates to several members of the Section; and dancing.

Nelson S Knaggs, vice president, Hilton-Davis Chemical Co, personally showed the all-color film which he made in 1956 during his visit to the tiny kingdom of Nepal. The film reveals the life of the people in this remote Himalayan country. Against a backdrop of 25,000-ft, snow-mantled mountains, it explores the ancient Nepalese capital of Khatmandu, a city of pagodas and temples, domes and shrines, narrow streets, slender pillars of gods and kings, and ornate gilt carvings with woodwork delicate as lace. Great Buddhist shrines are shown, and the beautiful rice harvest unfolds in a Shangri-la setting.

Mr Knaggs is also a vice president of the Cincinnati Museum of Natural History, an active resident member and member of the board of directors of the Explorers Club of New York and a past president of the Cincinnati Travel Club and the Cincinnati World Trade Club.

Washington

WASHINGTON SECTION met April 3rd at the National Institute of Drycleaning, Silver Spring, Md, to hear of progress of a joint study by NID and the Univ of Maryland on ways to care for "wash-and-wear" suits and slacks.

Members of these organizations presented a panel discussion in the form of a progress report covering the first year's work.

Dorothy S Lyle, director of consumer relations at NID, served as moderator of a panel which included the following, all from the Univ of Maryland: T Faye Mitchell, head, Textile & Clothing Dept; June Wilbur, professor of home economics; and Eleanor Young, assistant in textiles and clothing.

Mid-West

MID-WEST SECTION held its Spring Meeting at the Schroeder Hotel, Milwaukee, Wis, on April 25th with 84 members and guests attending the afternoon meeting, and 117 attending dinner.

Speaker of the afternoon was Burton E Frank, supervisor, narrow ribbon control, Minnesota Mining & Mfg Co, St Paul, Minn. His subject was "Nonwoven Fabrics". At the time the technical session was in progress, lady guests attended a tea and fashion show.

During the business session, Elliott Morrill, AATCC vice president (Western Region) briefly reviewed the activity at the last two Council meetings.

Joseph H Jones, chairman of the Scholarship Committee, commented on the lack of funds in the Section's treasury, and recommended discontinuance of Scholarship Awards at this time. The Section voted to discontinue them until such time as a continuing source of revenue may be obtained for sustaining same.

Arthur T Teichner was appointed chairman of the Outing Committee, which will handle plans for the Section's two-day outing to be held June 12-13 at Brown's Lake Resort, Burlington, Wis.

E M Eddington was elected to complete the unexpired term of Councilor left vacant by E A Stern's moving from the Section.

A cocktail party sponsored by suppliers preceded dinner.

Southeastern

THE Spring meeting of the Southeastern Section was held at the National Guard Armory, Cedartown, Ga, on Saturday, April 18, 1959.

The speaker at the technical session was C H Lighthipe, technical director, Nopco Chemical Co, whose subject was "Natural and Synthetic Fiber and Yarn-Processing Aids".

A banquet was served buffet style at 7:30 pm, during which the $500.00 scholarship, awarded annually by the Section, was presented to Shepherd Albert Odom Jr, as student in the A French School of Textiles, Georgia Inst of Technology.

An unprecedented and highly successful feature of this meeting was a round table discussion on research, moderated by Cecil B Ray, Pepperell Mfg Co, Pepperell, Ala.

All arrangements for the meeting were handled by John N Gammon, Nopco Chemical Co.

Charles Lighthipe, Nopco Chemical Co, speaker at the Southeastern Section's April 18th meeting

Rhode Island

RHODE ISLAND SECTION held its annual Student Night Meeting on April 24th at Johnson's Hummocks Grill, Providence, RI.

Speakers of the evening included Martin J Lydon, president, Lowell Technological Institute, who discussed "The Need and the Opportunities for the Textile Chemist"; Frederick G Taylor, dyer, Kenyon Piece Dyeworks, whose subject was "The Dyeing Characteristics of Direct Dyestuffs"; Leonard Alves, a student at Bradford Durfee College of Technology, who spoke on "Estimation of Soaps in Woolens and Worsteds"; and Kenneth Kohanson, a student at New Bedford Institute of Technology, whose subject was "Chelating Agents".

James Pilkington, Riveredge Printing Co, handled arrangements for the meeting. He was assisted by Theodore S Clarke, E I duPont de nemours & Co, Inc.

L to r: A Kempton Haynes, Rohm & Haas Co, custodian, Southeastern Section; Shepard A Odom Jr, recipient of the Section's Scholarship Award and a student at Georgia Tech; Robert B Hallowell, Coats & Clark, Inc, Section chairman

L to r: James Pilkington, Riveredge Printing Co, in charge of the Rhode Island Section's Student Night Meeting arrangements; Martin J Lydon, president, Lowell Technological Inst; William J Holland, president, New Bedford Inst of Technology

RHODE ISLAND SECTION STUDENT NIGHT—L to r: Arthur W Godfrey Jr, chairman, Rhode Island School of Design Student Chapter; Kenneth C Hokonson, New Bedford Inst of Technology, student speaker; Richard Ormerford, chairman, New Bedford Inst of Technology Student Chapter; Leonard Alves, Bradford Durfee College of Technology, student speaker; Arthur L Canovel, chairman, Bradford Durfee College of Technology Student Chapter; Frederick G Taylor, Rhode Island School of Design and Kenyon Piece Dyeworks, Inc, student speaker.

"THE APPLICATION OF VAT DYES"

Monograph No. 2

American Association of Textile Chemists and Colorists

MONOGRAPH NO. 2, which deals with "The Application of Vat Dyes" was prepared by a board of editors and collaborators in the American Association of Textile Chemists and Colorists. This group represents a complete cross-section of the entire industry so that the text of the Monograph represents information both from laboratory and practical plant standpoints.

The Monograph contains approximately 385 pages with contents of various chapters as follows:

I HISTORY — Natural Indigo and Tyrian Purple; Development of Synthetic Vat Dyestuffs; History of Application of Vat Dyes; The Application of Vat Dyes to Fibers Other Than Cotton.

II PRINCIPLES OF VAT DYE APPLICATION — Types and Forms of Vat Dyes in Commerce; Chemistry of Application; Stripping and Redyeing Faulty Vat Dyeings; Fastness; Print Discharges; Change of Shade in Artificial Light; Dichroic Dyes.

III APPLICATION TO COTTON RAW STOCK — Equipment Used; Methods of Color Application; Typical Examples.

IV APPLICATION TO COTTON SKEINS—Equipment and Methods.

V APPLICATION TO COTTON WARPS—Short Chain Method; Long Chain Warp Dyeing; Continuous Pigment Padding Method.

VI APPLICATION TO COTTON PACKAGES—The Package; Package Dyeing Machines; Chief Factors in Dyeing Packages with Vat Dyestuffs; Dyeing Speed and Levelling Power of Vat Dyes; Dyeing Methods; Oxidation and Finishing; Vat Dyeing on Beams; Illustrative Dyehouse Procedures.

VII APPLICATION TO COTTON PIECE GOODS—History; Jig Methods; Padding Methods; Continuous Methods; Overhead Reel Method; Vat Dyeing of Cotton Narrow Fabrics.

VIII HOSIERY — Application of Colors to Cotton Hosiery; Application of Colors to Mixed-Fiber Hosiery.

IX APPLICATION TO FIBERS OTHER THAN COTTON—Vat Dyeing of Viscose Rayon; Vat Dyeing of Cellulose Acetate; Vat Dyeing of Nylon; Vat Dyeing of Animal Fibers.

X GENERAL PRINCIPLES OF PRINTING — Piece Goods; Forms Other Than Piece Goods.

XI PRINTING — Direct Printing with Vat Dyestuffs; Discharge Printing with Vat Dyestuffs; Goods Dyed After Printing.

XII INDIGO—History and Properties; Various Indigo Vats and their Preparation; Dyeing of Cotton with Indigo; Dyeing of Wool with Indigo; Application of Indigo to Cotton Printing; Indigo Derivatives.

XIII THE USE OF VAT DYES AS PIGMENTS OR IN NONTEXTILE APPLICATIONS — Paper, Rubber, Plastics and Resins; Fireworks; Paints and Lacquers; Resin-Bonded Pigments; Miscellaneous.

XIV LEUCOESTERS OF VAT DYESTUFFS — History and Chemistry; Properties; Application of Leucoesters; Lightfastness of Leucoesters; Relative Cost of Vat and Soluble Vat Dyeing.

XV TABULATION OF VAT DYESTUFFS—Formulae and Properties; Numerical Index; Alphabetical Index; Trade Names of American-Made Vat Dyes.

AUTHOR INDEX

SUBJECT INDEX

From the foregoing, it is seen that this Monograph gives a very comprehensive description of all of the factors involved in the application of vat dyes. In all discussions of application procedure, practical working formulas are given. This publication is of interest to all persons who are either producers or consumers of vat dyes.

The price of "The Application of Vat Dyes" is $5 per copy, postpaid, to members; to nonmembers it is $6 per copy. Quantity discount prices are as follows:

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• BOOK REVIEWS •

NOTES FOR A LABORATORY COURSE IN DYEING

Charles Hugh Giles
Society of Dyers & Colourists
19 Picadilly
Bradford 1, Yorkshire England
xi + 92 pages; 17s, 6d; postage 8d
(1957)

This publication is a 92-page paper-covered book, which concentrates primarily on experiments for a laboratory course in dyeing. In addition, however, brief sections dealing with fibers, dyes. color and absorption spectrophotometry are included. This is the only published laboratory course in dyeing.

The dyeing experiments were very carefully selected to acquaint the student with the principles of laboratory dyeing and to develop the student's ability to dye commercially important fibers by current methods. Seventy experiments are described for dyeing of cellulose, wool, silk, cellulose acetate, nylon, polyester, and polyacrylonitrile fibers. Fifteen experiments for the dyeing of fiber mixtures are given. For the most part, these experiments consist of dyeing of fibers, yarns, or fabric by standard dyeing procedures, which are briefly but adequately defined in the text. Brief discussion of the class of dye usually precedes each dyeing procedure. The author, who is a senior lecturer in chemical technology at the Royal College of Science and Technology, Glasgow, has carefully selected only those dyeing methods which are of greatest value to industry.

The book is well designed for a course of instruction in practical dyeing and for dye company trainees. It will prove valuable to anyone interested in these objectives. It would also be a very convenient reference manual for standard laboratory dyeing procedures because of its broad coverage of dyeing methods.—RJP.

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY (First supplement volume)

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250 Fifth Ave, New York 1, NY
$25.00

Volumes 1 through 15 of this encyclopedia comprise a comprehensive summary of industrial knowledge on materials, methods, processes and equipment for the chemist and chemical engineer. The first volume appeared in 1947, the 15th and last volume in 1956. In the intervening time, much has gone on in the chemical industry and the editors, in accord with their original intent, have brought their work up to date in this *First Supplement Volume.*

Before attempting this task they were required to examine their objective of bringing an encyclopedia "up-to-date." They found that many of the articles in the encyclopedia could not be improved except by adding a few new annual statistics, some descriptions of minor improvements in production methods, and some new uses. Other articles, however, required complete revision and entirely new sections would have to be added to keep the encyclopedia up to date. "Automation" and "Computers" were hardly heard of when the volumes containing "A" and "C" were published. "In other cases, a slight shift in emphasis produced an aspect of a subject that deserved to be treated; the original volumes had a number of articles on dyes and dyeing, and on the various synthetic fibers, but the dyeing of synthetic fibers is treated only in this Supplement Volume." So, in view of the necessity of keeping the revision to a practical minimum, it was decided that only those subjects that had undergone a fundamental change would be treated and where and when possible new articles would be added to complete the work. "The fifty-one articles in the supplement volume are arranged alphabetically, and contain cross references to the original volumes as well as to this volume."

The supplement volume is well illustrated and the list of contributors to the First Supplement Volume is impressive. The editorial policy is praiseworthy and practical. The editors have fulfilled their objectives admirably.—RJK.

CHEMIE DER AZOFARBSTOFFE CHEMISCHE REINE—BAND 13

Heinrich Zollinger, Univ of Basel
Birkhaeuser Verlag
Basel & Stuttgart
308 pages; 16.5 × 24 cm; DM 36.25
(1958)

In this latest volume of the Chemical Series of Monographs on the Exact Sciences, the chemistry of the azo dyes is discussed from a chemical rather than an industrial standpoint. The subject matter ranges from a general introduction to the physical-chemical rudiments of dyeing. Volume 13 discusses the following topics: Physical-chemical Considerations, Definitions, and Investigation of Reaction Mechanisms (10 pages); Methods of Diazotization (9 pages); Mechanisms of Diazotization (15 pages); Diazo-equilibrium (16 pages); Isomerization of the Diazo Substituent (12 pages); The Diazo Decomposition Reaction (22 pages); Diazo-Amino Compounds (13 pages); Methods of Production of Azo-Compounds (20 pages); Mechanism of the Coupling Reaction (26 pages); Uses of the Coupling Theory in the Technology of Azo Dyes (20 pages); Review of the Technical Azo Dyes (25 pages); Connections between Constitution and Properties of Azo Dyes (20 pages); Chemistry of Metal Complexes of Azo Dyes (24 pages); Uses of Azo Dyes in the Dyehouse (14 pages); and Physical-Chemical Rudiments of Dyeing (22 pages).

Extensive literature references including the patent literature are found throughout each chapter. A brief but concise discussion of the above-mentioned topics is coupled with well-defined structural formulas.

This Monograph is highly recommended for chemists interested in the field of azo dyes or those related thereto.—RMP.

INORGANIC SYNTHESES VOL V

Therald Moeller, editor-in-chief
McGraw-Hill Book Co
New York, NY
xiv + 265 pages; 19 figures
16 × 23.5 cm; $6.00 (1957)

This is the fifth volume of the well-known series dealing with inorganic syntheses. Exact and tested procedures for the preparation of inorganic substances are made available. Each synthesis has been checked carefully in at least one independent laboratory. Many of the procedures either originated or were checked in industrial laboratories, which is indicative that the material is of both technical and fundamental interest.

Some of the procedures included in this volume are: Sodium hydride; disilver fluoride; boron fluoride—trimethylamine; organosilazane compounds; nitrogen (IV) oxide; purification of sodium tetrametaphosphate; anhydrous metal chlorides; chlorine (I) compounds (chlorine (I) oxide, chlorine (I) oxide in carbon tetrachloride, hypochlorous acid, and calcium hypochlorite).

The procedures are well written, with footnotes included. A bibliography is found at the end of each procedure. The editors are to be commended for this valuable contribution to inorganic chemistry.—VL.

THE HANDBOOK OF CHEMICAL DATA

F W Atack, editor
Reinhold Publishing Corp
430 Park Ave, New York 22, NY
629 pages incl 12 index; $6.75

THE HANDBOOK OF CHEMISTRY AND PHYSICS 39TH ED

Charles D Hodgman, editor
Chemical Rubber Co
Cleveland, Ohio
3213 pages incl 40 index; $12.00

As the 39th edition of "The Handbook of Chemistry and Physics" was announced, a new handbook also became available from booksellers. The new "Handbook of Chemical Data" appeared in earlier years as part of two volumes that constituted "The Chemists' Year Book." The section of "The Chemists' Year Book" previously devoted to tables and constants has now been renamed and is issued as this separate handbook. Unlike "The Handbook of Chemistry and Physics," it is a pocket-sized book. It of course must sacrifice in coverage, even in things as important to the chemists as physical constants of organic and inorganic substances. In many respects the smaller volume is an excellent supplement for the larger work. It contains excellent sections on qualitative analysis and volumetric analysis along with solubility and solution density charts that would be particularly helpful to the laboratory chemist. It also contains many practical collections of data, such as densities of various substances including asbestos, leather, sandstone and the like. These are facts that would be difficult to find elsewhere.

This new volume is edited by F W Atack, who is famous for his book "Organic Dyestuffs" (1914), which was the first book on the subject in English. The fact that this man is associated with the dyestuff industry should make this book particularly suited to the needs of dyestuff chemists, as what Dr Atack thinks is important enough to include in this volume is no doubt dictated somewhat by his own past needs.

As intimated, the reviewer does not feel this book is a substitute for the larger, popular "Handbook of Chemistry and Physics, but as a pocket reference it is excellent.

The new 39th edition of "The Handbook of Chemistry and Physics" includes new tables of nuclear spin, moments and relative sensitivities for those interested in the field of nuclear magnetic resonance. Included among other new additions are four tables about various sugars and new tables of dielectric constants of pure liquids and substances in the gaseous state. There has been much revision of the old tables in accord with the latest laboratory findings. This book still is one of the outstanding aids to experimentalists in all branches of science. —RJK.

THE TECHNOLOGY OF CORDAGE FIBERS AND ROPE

David Himmelfarb
Textile Book Publishers, Inc
250 Fifth Ave, New York 1, NY
370 pages; $5.50

This volume contains a comprehensive presentation of the technology and basic principles of cordage fibers, ropes, and ropemaking. Data illustrating technology and showing the development of principles is compiled in 91 tables and 59 figures. This data is carefully discussed in the text.

The subjects covered and their division is as follows: Cordage fibers, classification, use properties, growth, etc; Ropemaking, fiber preparation, yarn spinning, twisting, and braiding; Finishing, quality control, and factors of variation; Rope properties and protection from deterioration; Performance characteristics, classification and identification of ropes and cordage.

This book represents a significant contribution to technology because it has most of the technical information available in the field where few reference books are available.—RJP.

ADVANCES IN PETROLEUM CHEMISTRY AND REFINING VOL I

Kenneth A Kobe and John J McKetta Jr, editors
Interscience Publishers Inc
250 Fifth Ave, New York 1, NY
641 pages; $13.50 (1958)

This is the first volume of a series that will attempt to familiarize the petroleum engineer and executive with what the research scientist is doing in this field and also in turn to familiarize the research scientist with what the engineer is doing. To achieve this, the editors intend to "present at annual intervals a collection of progress reports written by leading authorities on particular subjects."

The editors have conceived a blueprint of the whole industry divided into five main sections: Economic and Future Trends, Unit Operations and Design, Refining Processes, Petrochemicals, Mechanical Equipment. Each year they will choose topics from each of the different sections and arrange them within the volume in the sequence given above.

Volume I discusses several broadly applicable industrial chemical techniques that would be of interest to people of the dyestuff industry. Separation and purification by crystallization is discussed by Findlay and Weedman. Superfractionation, azeotropic and extractive distillation are discussed by S B Zdonik. Alkylations of paraffins is discussed by John O Iverson and Louis Schmerling. Solvent refining is discussed by Alfred Francis and William King. Solid polymers and surface catalysts are discussed by Herbert Fiedlander and William Resnick.—RJK.

THE CHEMICAL BEHAVIOR OF ZIRCONIUM

Warren B Blumenthal
D Van Nostrand Co, Inc
120 Alexander St, Princeton, NJ
vi + 398 pages; 16 × 23.5 cm; $11.00
(1958)

The author has made a valuable addition to the chemical literature through this comprehensive treatment of the chemistry of zirconium and zirconium-containing substances. This is the first compilation in this area since 1922. The book is written in clear, concise, up-to-date terminology and both the earlier and later literature are presented. More important, the earlier literature has been recast in view of recent theoretical concepts.

The following topics are discussed: The Element Zirconium; Interstitial Solutions and Intermetallic Compounds; Zirconium Halogenides; Zirconium Oxides and the Zirconates; Zircon and the Complex Silicates; The Sulfatozirconic Acids, Sulfates and Sulfonates; Compounds of Other Inorganic Acids; Carboxylates of Zirconium; Organic Compounds Other than the Carboxylates. Each main chapter is broken down into subdivisions, which greatly aid the overall presentation of the material. Furthermore, extensive literature references enhance the utilization of the text.

Of particular interest to the textile chemist are the sections on zirconium alkoxides and their utility in the preparation of water-repellent composition for textiles. Zirconium compounds of the dyes dihydroxyazobenzene and Pyrocatechol Violet are also discussed. The chemistry of zirconyl chloride is covered with reference to its use as a starting material for preparing other zirconium compounds useful as water repellents, lakes and toners, and as vehicles for textile printing.

Mr Blumenthal, who is chief of chemical research, Titanium Alloy Mfg Div, National Lead Co, Niagara Falls, NY, is to be complimented on making this contribution to the chemistry of zirconium. This text will certainly play a large part in opening up new areas of research in this rapidly expanding field of endeavor.—RMP.

News of the Trade

Nopco Acquires Jacques Wolf & Co

Nopco Chemical Co has acquired all the capital stock of Jacques Wolf & Co, Clifton, NJ, in a cash transaction. The purchase price, reportedly more than $3,000,000, did not exceed the net worth of Jacques Wolf at the time of purchase. Wolf's annual volume of sales has been between $5-6,000,000 for the past five years.

Nopco will operate Jacques Wolf as a wholly owned subsidiary, retaining its present staff and sales force. G J Desmond and Arnold Pfister, Wolf officers, will continue to serve in their present capacities, while G Daniel Davis, Nopco executive vice president, becomes president of Jacques Wolf.

The new officers of Jacques Wolf & Co, along with Mr Davis, are Nopco vice presidents Harry A Batley and Harold A Swanson, who become vice presidents, and Nopco assistant secretary Julius J Denzler, who assumes the responsibilities of assistant secretary. Mr Desmond will be treasurer and Mr Pfister secretary in the new organization.

Jacques Wolf salesmen, many of whom are long-time employees of the company and experienced in the field, will remain as Wolf representatives in their established territories.

Jacques Wolf offices, laboratories, and some manufacturing facilities are located in Clifton, while the main plant is on a 13-acre site at Carlstadt, NJ. Nopco has plants in Harrison and North Arlington, NJ; Cedartown, Ga; Richmond, Calif; and London, Ontario, Canada.

In announcing the acquisition, Nopco president Ralph Wechsler stated that the combined resources and experience of these two companies — both more than 50 years old—would aid measurably in their mutual growth and development, and would equip them to better serve the chemical world.

"Fashions in Fibers" Panorama

The Design Center for Interiors, 415 East 53rd St, New York 22, NY, is currently sponsoring a new panorama, title "Fashions in Fibers," under the direction of Tom Lee, display consultant to the Center.

The exhibit features hundreds of fabric and carpet samples in a comprehensive display of the latest developments in natural and man-made fibers.

Demonstration Unit for Si-Ro-Set

Manufacturers of skirts and slacks can now attend actual equipment demonstrations in Manhattan of the new permanent pleating and creasing process using Si-Ro-Set solution.

A complete unit to demonstrate the process for wool garments has been set up in the laboratories of Evans Chemetics at 250 East 43rd Street. Automatic spraying equipment specially designed for the process has been installed. The spraying devices complete a production layout where garment manufacturers and mills may see the complete Si-Ro-Set technique. This covers the spraying of a wool garment, setting and steaming in a press or autoclave, and drying.

While manual presses have been converted to automatic presses and automatic presses have been specially designed and are being used, slacks or skirt manufacturers can use their regular pressing and steaming equipment for the process.

Evans Chemetics, which is one of the producers of the Si-Ro-Set concentrate used in the process, is working with the Wool Bureau in the New York area to introduce the process to manufacturers and mills. The laboratory will also service manufacturers in the Metropolitan area who wish to test-pleat wool fabrics at no cost to the manufacturer. Arrangements for demonstrations and test-pleating can be made with Sam Williams at Evans Chemetics.

Gerald Laxer and Charles Macaluso of the Wool Bureau's Department of Science and Technology can be called on by manufacturers, mills and pleaters for technical assistance on all phases of Si-Ro-Set installation.

Developed in government laboratories in Australia, the process, called Si-Ro-Set after the Commonwealth Scientific and Industrial Research Organization, was turned over to the Wool Bureau's Department of Science and Technology last year. The Bureau was assigned to adapt the process to American production methods and then release complete instructions to all American apparel manufacturers—at no cost, and free of any royalties.

A pilot plant was installed at the Lackawanna Pants Manufacturing Co in Scranton, Pa, where spraying, pressing and drying techniques reportedly were perfected. This pilot plant has now been converted to full-scale production.

Staley Entering Synthetic Polymer Field

The A E Staley Manufacturing Co, Decatur, Ill, corn and soybean processor, is entering the synthetic polymer field.

Announcing the move, Staley president E K Scheiter said it is part of the company's stepped-up research and diversification program launched three years ago.

A polymer pilot plant put in operation at Decatur early this year is now in semiworks production of acrylic type emulsions, Mr Scheiter said. The Staley Company also recently announced plans to acquire the U B S Chemical Corp of Cambridge, Mass.

Acquisition of the chemical concern, subject to approval of U B S stockholders, will add that company's chemical plant and laboratories at Cambridge, a new polymer plant put in operation recently at Lemont, Ill, a polymer plant and laboratory currently under construction at Marlboro, Mass, a technical laboratory near Greenville, S C, and other U B S facilities.

"Although Staley's entry in the synthetic polymer field may seem something of a departure," Mr Scheiter said, "it is rather a logical extension of the company's traditional interest in natural polymer products derived from corn and soybeans."

The Staley Company began corn refining operations 50 years ago, and pioneered with America's first commercial soybean processing in 1922.

"The addition of these synthetic chemical products now means that Staley's is preparing to meet industrial requirements over a wider range of both natural and synthetic derivatives, as well as combinations of the two," Mr Scheiter said.

Staley research developments in synthetic polymers are centered on resin emulsions for industrial uses.

Third International Textile Machinery Exhibition

Milan, Italy will be the site of the 3rd International Textile Machinery Exhibition to be held Sept 12-21 at the Milan Fair.

More than 530 manufacturers of textile machinery and accessories will exhibit in approximately 366,000 sq ft of space. Detailed arrangements for the Exhibition will be handled by Associazione Costruttori Italiani de

Macchinario per l'Industria Tessile under the auspices of the Comite Europeen des Constructeurs de Materiel Textile.

Information relating to the Exhibition for visitors may be obtained on request from: Segreteria Generale, EIAT 59, Via Baracchini 10, Milano, Italy.

Brochures and reply cards may be obtained in this country from Ernest L Frankl Associates, 515 Madison Ave, New York 22, NY.

Ernest L Frankl Associates advises that, if enough can arrange to travel in a group, charter air travel arrangements will be made, resulting in very favorable rates, which would be considerably less than a normal air fare.

Ciba HQ Relocated in NJ

The headquarters of Ciba Co Inc has been relocated from 627 Greenwich St, New York, NY, to an entirely new and modern building in Fair Lawn, NJ. Included in the move, which became effective May 18th, are all elements of Ciba's central staff, customer service laboratories, central warehouse facilities and the Metropolitan District sales office and laboratories.

Harry B Marshall, president, Ciba Co Inc, has stated "we believe that our decision to move out of New York City is a logical one and that it affords us an even greater opportunity to serve our customers in a prompt and efficient manner."

A booklet prepared to explain the advantages which the Company believes will be gained from the relocation offers the following:

"Over the past 38 years we have seen our modest beginnings in the sales of dyes and chemicals in the USA grow steadily to a point where our sales and customer service activities in dyes, chemical specialties and pigments now require new and expanded facilities.

"Particularly in the years since the end of World War II, the growth of our Company has been accelerated by several contributing factors. First and foremost has been the dedication of Ciba in the field of basic research to the objective that new and improved dyes and chemical specialties could be brought on the market to keep pace with both the ever-widening assortment of man-made fibers and blends and the higher demand for quality in all dyes-consuming industries. Typical of recent technological contributions by Ciba are the Cibanone Microfined vat dyes, the Cibalan and Microfix dye groups and of course the glamorous, all-new Cibacron dyes that are adding a new dimension to high-fashion styling. With so many new developments, we urgently needed modern installations that would permit us to stay abreast of our responsibilities.

"A further factor that has contributed to the growth of Ciba Company Inc since World War II has been a diversification program designed to place greater emphasis on dyes-consuming industries outside of the textile industry. The Company's determination to secure greater recognition in the chemical specialties, paper, leather and metal processing fields has brought with it a need for space to house specialized personnel and equipment to service these important industries. In the last year or two, the foundations have been laid for the Company's entry into the pigment field as well, thus necessitating the installation of laboratory facilities to service the paint, plastics and printing inks industries, which facilities were not available at our Greenwich Street location.

"In addition to the motivation to relocate provided by the above-described company growth, there must be added the important considerations of convenience to customers and suppliers alike and the desire to work and live in an uncongested community. We wanted a modern, attractive one-story building, well landscaped and located in pleasant surroundings. We wanted the people who work for Ciba to be able to live near by in prosperous communities with good housing, schools and all the other attributes of today's way of life. Finally, we wanted to be reasonably close to the banking and commercial facilities of New York City and to be more conveniently located in respect to our affiliated supplier of dyes, pigments and chemical specialties in Toms River, New Jersey.

"After thorough study, Fair Lawn, New Jersey was selected as the location most closely fulfilling these various requirements. Fair Lawn is located within easy reach of New York City. Toms River is only an hour and one half by automobile. The New Jersey Turnpike, Garden State Parkway, New York State Thruway and the Newark Airport are just a short distance away.

"The textile section of our laboratory is designed to provide technical service in all methods of textile dyeing and printing, including modern continuous dyeing techniques and other processes in which laboratory procedures can simulate plant conditions. Experienced technical personnel and modern equipment have been added to the chemical specialties, pigments, paper, leather and metal processing laboratories to strengthen our contributions to these important industries."

"Fair Lawn Industrial Park is itself a most attractive location for industry. The following list gives an idea of the calibre of our new neighbors: Eastman Kodak, Fisher Scientific Company, Fairbanks Morse & Company, New Jersey Bell Telephone Company and National Biscuit Company. The Park is situated in the heart of an attractive residential community where all the necessities for good living are readily available.

"The new home of Ciba Company, Inc is a modern, T-shaped, one-story building, conditioned for comfortable heat and humidity control, containing approximately 80,000 square feet. It was designed to blend harmoniously with the neighborhood with artistic landscaping to enhance the exterior.

"Color has been made the central theme of the new building, as befitting the nature of our business. Color is evidenced on the outside in the form of colored glass panels and dyed aluminum window frames are used throughout. On the inside of the building, color has been blended harmoniously in all areas, and in the cafeteria multicolored bricks flanking the serving area look down on a tricolored tile flooring. To demonstrate our faith in the products we make, we have used them wherever possible. The cafeteria tiling just mentioned is based upon an epoxy resin formulation, the resin having been supplied by an affiliated company, Ciba Products Corporation. The aluminum exterior window frames have been anodized and dyed both black and gold using Ciba's Oxanal dyes. Carpets in the building have been dyed with Ciba dyes wherever it could be arranged. For instance, the brilliant red carpet in the technical division conference room was processed with a combination of Cibacron dyes.

"The move to Fair Lawn is part of an over-all program to transfer Ciba's personnel in the United States to modern and efficient facilities in the State of New Jersey. By 1960 there will be nearly 3,000 employees in the dyes, plastics, chemical specialties and pharmaceutical divisions of Ciba in the USA conducting business from the State of New Jersey.

"The new quarters at Fair Lawn are an outstanding example of good planning and modern architectural design.

"In planning our new building, we have given special consideration to customer service facilities. It has long been a point of pride at Ciba to provide prompt and efficient technical and delivery service, and we have taken the occasion of our relocation to modernize and add to our equipment."

Makers of Lestoil Celebrate Silver Anniversary

Adell Chemical Co, makers of Lestoil, recently completed five days of celebration in connection with the firm's 25th Anniversary and completion of a new 90,000 sq ft addition at the Holyoke, Mass site. Guided tours were held each day from May 18 to May 22, and a special exhibit depicted the 25-year history of Lestoil.

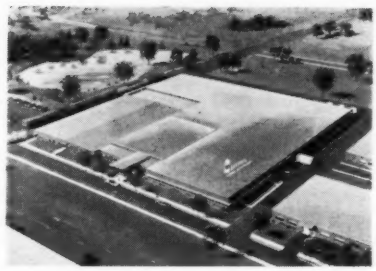
Lestoil was discovered and developed in 1933 by Jacob L Barowsky, founder and president of Adell Chemical Co, and has been sold industrially to textile mills, pulp and paper mills, commercial launderies, and for maintenance cleaning from the early years. d-2 Lestoil Liquid Detergent is used by the textile industry for removal of grease, oil, graphite, natural wax, gum, soluble sizing and mill dirt. It is also said to be effective in preventing soil redeposition, and can be used on all fabrics for spotting, padding, or in the scour.

With the new addition to the plant, the firm now has a total of 150,000 square feet of plant and office space. Total storage capacity of the plant is approximately one million gallons.

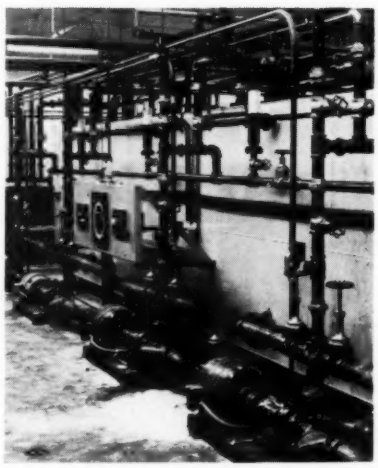
In the new plant are five completely automatic bottle production lines and one completely automatic line for half-gallon cans of Lestoil. Present production capacity is now 100 million bottles per year with one shift. New offices for Lestoil, Inc, a subsidiary of Adell Chemical Co, will use over 15,000 square feet of the new building with the remainder devoted to plant operation. Jackson Associates, Lestoil's advertising agency, will use the entire office space vacated by Lestoil, Inc.

The fantastically rapid growth of Lestoil over the past five years has been dramatically portrayed in magazines, newspapers, and films: From 10 employees in 1954 to 250 today, from $60,000 in advertising expenditures in 1954 to over $10 million today, from one production line in 1954 to six today, from 20,000 square feet of rented space in 1954 to 150,000 square feet of new construction today, from a distribution area of Holyoke and immediate vicinity in 1954 to coverage of 24 states, the District of Columbia, eastern Canada, Puerto Rico, and the Bahamas, from producing 1½ million bottles a year in 1954 to over 100 million a year now.

At the Open House Ceremonies, which were attended by state and local officials, TV newspaper and magazine figures, suppliers and other friends of Lestoil, Inc, Mr Barowsky received the Massachusetts Dept of Commerce Special Achievement Award from Commissioner John T Burke. He also received awards from WHYN-TV, first TV station used to advertise Lestoil; Knox Glass Co and a distributor, Feldman Glass Co "in recognition of 25 years of outstanding leadership in modern manufacturing, merchandising and advertising."



Artist's sketch of Lestoil, Inc's newly expanded 150,000-sq-ft plant at Holyoke, Mass



Lestoil is mixed in these tanks, then sent to another tank for strict quality control. From the quality control tank, Lestoil is piped to supply tanks for the production line.

Emery Moves Chicago Office

The Chicago office of Emery Industries, Inc, has been moved to new quarters at 6835 West Higgins Ave, Chicago 31, Ill. The new telephone number is Rodney 3-5747.

The new location reportedly provides easier access to the entire Chicago area. Emery's present warehousing operation in Chicago will continue unchanged.

The office will serve as headquarters for Joseph E Quinty and Paul N Leech, sales representatives for Emery's Organic Chemical and Fatty Acid Sales Departments, respectively, in a five-state territory surrounding Chicago.

GAF Appoints New Distributor in Southwest

The appointment of Texas Solvents & Chemicals Company as distributor for Igepal CO- and CA- surfactants and Cheelox sequestering agents, has been announced by Antara Chemicals, a sales division of General Aniline & Film Corp. These products, in drum and bulk quantities, will be warehoused in Houston and Dallas, and truck delivery will be provided in these cities, and in all of Texas, Oklahoma and western Louisiana.

Available from these warehouses are drum stocks of all Igepal CO- and CA- surfactants and Cheelox sequestering agents. It is stated that significant savings may be realized through the purchase of mixed truckloads of drums of the surfactants and/or sequestering agents and other products supplied by Texas Solvents.

Igepal CO-630 and Igepal CA-630 in bulk quantities reportedly can be delivered in tank trucks of up to 6,000-gal capacity. Also available are compartmented tank trucks, permitting mixed bulk shipments of Igepal surfactants or of these products and other liquid chemicals supplied by Texas Solvents. The blending of two or more surfactants reportedly can be provided those customers desirous of this service.

Premier Knitting to Use Mitin in '59 Sweater Line

All 1959 lines of quality wool and cashmere-fur blend sweaters manufactured by Premier Knitting Company, Inc will be permanently mothproofed against damage from wool-eating insects, according to a recent announcement by Arnold A Saltzman, president of the leading sweater firm.

Production of Premier's Kitt'n-gora lines at the company's main plant in Blackwood, NJ, is now being treated with Geigy's Mitin durable mothproofer. According to Mr Saltzman, Mitin does not affect the feel of knitted fibers and its effectiveness remains through repeated washings and drycleanings.

Premier Knitting Company is one of the oldest and largest manufacturers of fine women's sweaters. Its Kitt'n-gora fur blend and all-wool lines retail at prices ranging from $7.95 to $25.00.

Commercial Production of Polypropylene Fiber to Begin in Italy

Commercial production of Moplen polypropylene textile fibers will begin in Italy at the end of this year according to information just released by Piero Giustiniani, managing director, Montecatini Soc Gen, Milan, Italy.

In a presentation before officials of leading Italian textile firms, Dr Giustiniani and Silvio Larcher, general manager of Polymer Company of Italy, an associated firm of Montecatini, said that the new polypropylene textile fibers (to be produced by the Polymer Company) have unusuallyhigh heat resistance, extremely light weight and high strength. The new synthetic has been used successfully in cotton-like and wool-like fabrics as well as in various blends with natural cotton and wool, they stated.

Based on the discoveries of Giulio Natta of the Polytechnic Institute of Milan in the field of stereospecific polymerization of alpha-olefins, the new isotactic polypropylene textile fiber is obtained from low-cost propylene gas, a petroleum byproduct. According to Dr Larcher, initial price for the staple on the Italian market will be about 60 cents per pound. The price however is expected to decrease as higher production rates are reached, he said.

The new fiber was exhibited in this country by Montecatini in the form of suitings, blankets and sweaters last November during the 8th National Plastics Exposition and before that in an experimental form at the Chemical Industries Exposition in 1957.

Moplen fibers are currently being produced in pilot plant quantities at the Terni, Italy, plant. Their low specific gravity (0.91), which is said to promise greater yields per unit weight of fiber compared to currently available synthetic fibers, is expected to contribute to the eventual low price of the material.

• NAMES IN THE NEWS •

Weldon G Helmus, formerly executive vice president of Fair Lawn Finishing Co, Fair Lawn, NJ, was elected president of the firm at its annual meeting held recently in Zurich, Switzerland. He succeeds **John J Evans**, who retires under the firm's pension plan. Mr. Helmus was also reelected treasurer.

George F Gaede has resigned as vice president and secretary. **James P Martin**, controller, has been named secretary, and **Harry Moore**, general manager, has been reelected vice president.

Mr Helmus has been with his current firm and its predecessor, Textile Dyeing & Printing Co of America, for 34 years. He became vice president of Fair Lawn in 1942 and was elected to the board in 1946. He has been very active in AATCC, which he presently serves as president. He has also served as vice president, councilor, and chairman of the New York (now Metropolitan) Section.

Mr Evans served as president of Fair Lawn since 1946, succeeding Charles H. Dimick. He served on the board of Fair Lawn and its former sister company, Richmond Piece Dye Works, Inc, for a number of years before becoming chief executive offices.

Thomas D Efland, associate professor of textiles since 1955, has been appointed head of the textile research department at Clemson College.

Prof Efland, who assumed his new duties May 1, will continue his teaching assignments through the current semester.

Prof Efland succeeds **William T Rainey**, who has resigned to accept appointment at the Oak Ridge (Tenn) Laboratories. He headed the department since its establishment in February of 1958.

Philip M Dinkins was re-elected president and, in addition, chief executive officer of General Aniline & Film Corp, by the board of directors at its annual election of Company officers.

John Hilldring, who had served as chief executive officer, was reelected chairman of the board. Mr Hilldring announced at the Company's annual meeting on April 14 that he will reach the retirement age next year and at that time will resign from active duty.

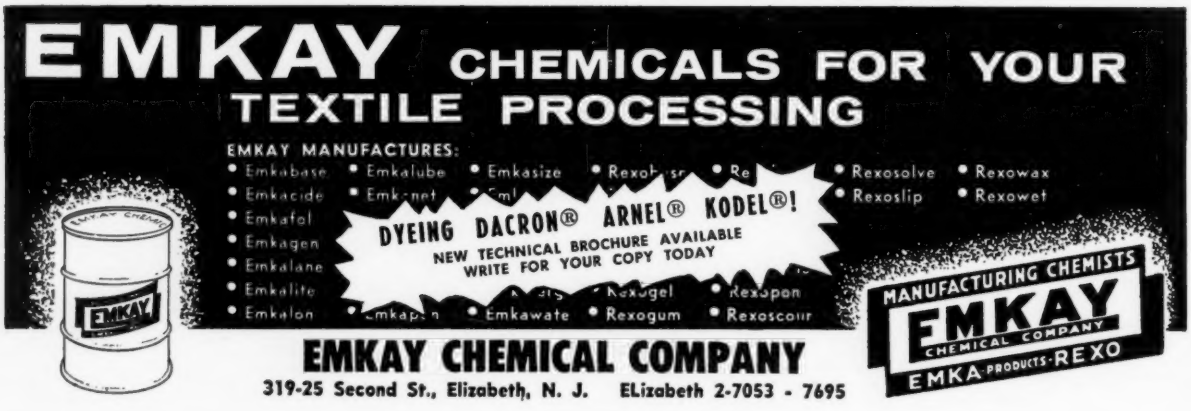
As president and chief executive officer, Mr Dinkins assumes full management responsibilities of the Corporation. Mr Dinkins, who was elected president last December, joined General Aniline & Film in 1955 as vice president and general manager of its Dyestuff and Chemical Division.

The Board also announced the reelection of all other officers. They are: **Francis A Gibbons**, executive vice president; **Leopold F Eckler, Matthew M Gouger, Walter A Hensel, Jesse Werner** and **Sumner H Williams**, vice presidents; **Arthur J Young**, controller, **Albert E Hendershot**, treasurer; and **C Joseph Hyland**, secretary.

Stanley Brooks was elected vice president in charge of sales of H W Butterworth & Sons Co, Bethayres, Pa, division of Van Norman Industries, Inc, at a Van Norman board meeting last month.

Mr Brooks was chief engineer of Textile Finishing Machinery Co, Providence, RI, until its purchase by Butterworth in 1944. After seven years in the New England sales office, he became chief engineer at Butterworth in 1951. Most recently his responsibilities have been in research and development, working on new processing techniques.

He succeeds **Edward S Pierce**, who recently resigned.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